POPULAR SCIENCE

Apr. 1949

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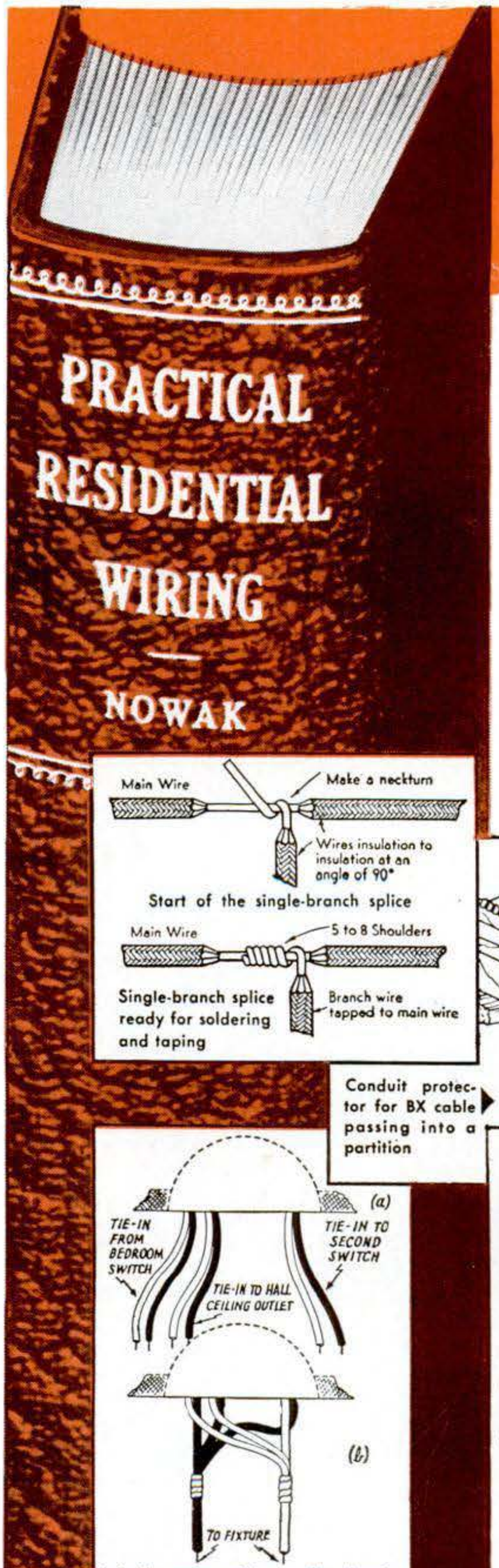
Monthly

First Pictures of Kaiser Utility Car

PAGE 106



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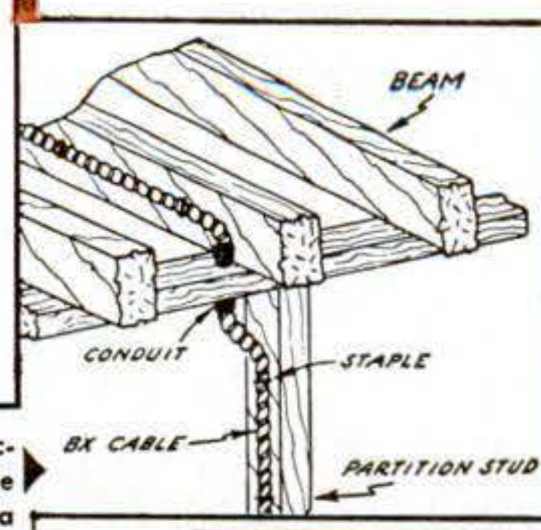
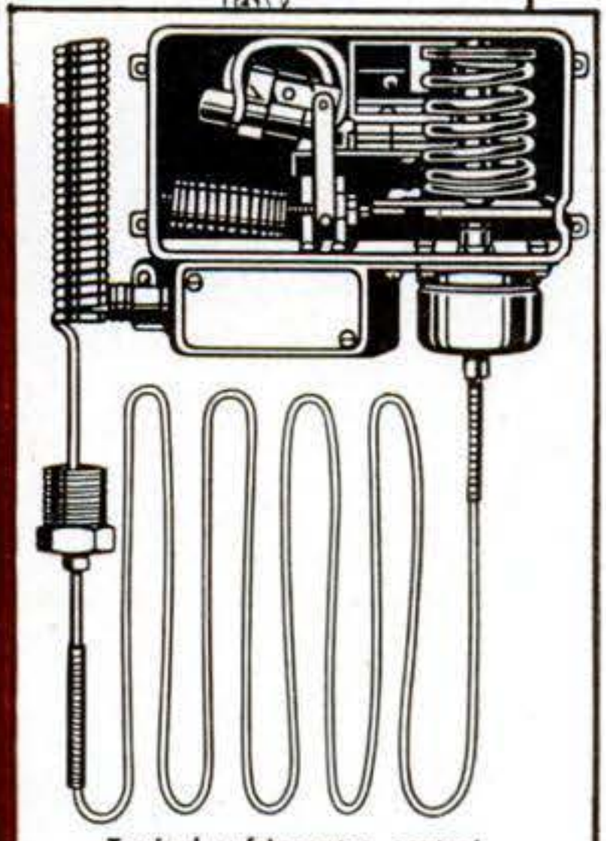
Start of the single-branch splice

Single-branch splice ready for soldering and taping



Conduit protector for BX cable passing into a partition

(a) Playroom ceiling outlet showing wires before splicing
(b) Same outlet showing wires after splicing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This section begins by taking all the mystery out of electric currents and the circuits built to carry them. It starts with the simplest possible case—the wiring of a single bulb—and then leads you, step by step to complete floor plans and wiring diagrams, connecting lights, switches, outlets, etc. Finally, it explains in detail how to make the actual installation, observing your community's Code regulations.

TOOLS AND HOW TO USE THEM

The great value of this section is the complete, specific directions for using the ordinary electrician's tools. The author, a man who has had years of practical experience, shows you exactly how to make splices that hold, soldered joints that stay, smooth bends in conduit or cable, etc. He describes every operation in complete detail, and explains all the tricks of the trade that assure you of turning out work of high professional standard.

METHODS OF WIRING

The four great chapters on methods of wiring constitute the most thorough, up-to-date and practical information now in print anywhere. All methods of wiring are discussed in detail, including open wiring on insulators, concealed knob-and-tube wiring, non-metallic sheathed cable wiring, wiring with armored BX cable, wiring in rigid conduit, and wiring for surface extensions. There is a complete, separate account of each of these methods, covering the type of installation for which it is best suited, its advantages and disadvantages, its Code restrictions and requirements, the necessary supplies, and the methods of installation with fully illustrated explanations of all operations.

HOW TO WIRE A BUNGALOW

This is the first of the complete electrical installations that are fully described in this book. It starts from the very beginning, with the actual floor-plans of the bungalow and shows you how to decide upon the number and position of the lighting fixtures to be installed, the switches to control them, the receptacles for power units, and the receptacles for lamps in each room. The author shows you how to prepare a wiring plan, how to prepare a bill of materials, and how to carry out every step in the actual installation.

HOW TO WIRE A ONE-FAMILY HOUSE

In this chapter the "watts-per-sq. ft." method of determining the number of outlets for general lighting purposes, is fully discussed by the author, and its application to the electrical needs in a full size, new house. An easy approach is made to wiring plans which require more than one branch lighting circuit. Making special provision for a small-appliance circuit is fully explained and illustrated.

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By JOHN F. NOWAK

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The great value of the detailed description of this complete project is that it introduces the use of wiring in rigid conduit, and also shows the manner of installing a 3-wire, single-phase alternating-current service together with the use of an artificial ground. The workshop and garage nature of the project show you how to provide for portable workshop power tools. The complete explanations, profusely illustrated, cover every step from the planning of the service to the connection of the power units and lighting fixtures.

WIRING A FINISHED HOUSE

Since the jobs described in earlier chapters were done on new houses, where the cable and wiring could be installed before the walls were plastered, this present chapter explains in full a complete electrical installation on a finished house. The methods are especially useful in house remodeling, and the author describes in detail an entire job, from the planning of the installation to patching holes in walls and ceilings, finishing the service wiring.

LIGHTING FIXTURES

The selection of lighting fixtures that are up-to-date in design and in accord with the room is most important to the appearance of the home. Furthermore, there is often a choice between incandescent and fluorescent lighting. All this information is fully presented, together with full directions for connecting and installing the various types of fixtures.

SIGNALING SYSTEMS

In addition to wiring for lighting and power, the home contains signaling systems serving such devices as doorbells, door opener releases, annunciators and burglar alarms. Their circuits are independent of the light and power wiring, and must be installed separately. The author covers completely such systems, beginning with the basic elements, and covering every step in the planning, installation, and repair of actual circuits.

TESTING AND TROUBLE-SHOOTING

This great fund of handy information will prove its value to you time after time. It guarantees the safety of every job you do. It gives you the quickest and surest methods for checking any new installation, and for locating troubles in any already-installed system that is not working properly. It covers electric lighting, power circuits, and signaling systems thoroughly. With this information you can be confident of correcting any of the troubles you are likely to encounter in a residential wiring system.

HOUSEHOLD ELECTRICAL APPLIANCES

Brought together within these pages are all the methods and practical suggestions, from the long experience of a master-electrician in servicing and repairing household electrical appliances. The author discusses all the major classes of appliances and their characteristic troubles—lamps, heaters, storage batteries and motorized appliances. The specific troubles of this last group include motor troubles, both electrical and mechanical. There are detailed directions, with clear "x-ray" pictures for trouble-shooting and repair.

GLOSSARY AND CODE TABLES

The final sections bring together, for instant reference, all the information about electrical installations in residences. The glossary gives you in plain, non-technical English the exact meaning of hundreds of terms, arranged in alphabetical order. The National Electrical Code tables summarize the provisions of the Code that apply to small-house wiring, and which have been explained throughout the book. From the first page to the last, this practical, brand-new book explains and illustrates every step in residential wiring so clearly and simply that you can do all the work in accordance with professional standards.

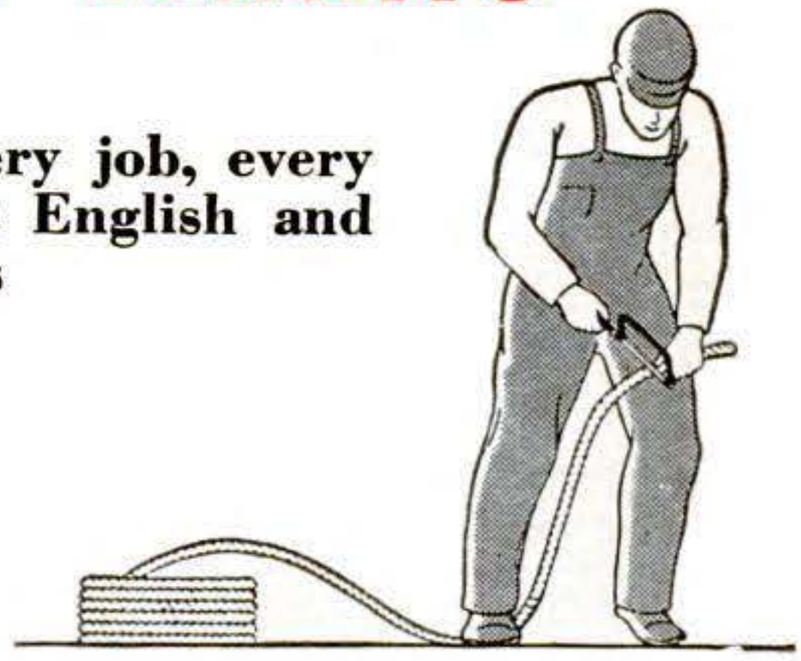

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TABLE OF CONTENTS

Science News

Stairway to Atomic Industry.....105
U.S. Lights New Atomic Pile for Peace..121
Mightiest X-Ray Machine.....133
1/250,000-Inch Slice Traps Genes.....142
Girl Builds Cloud Chamber.....152
"Apple Corer" Taps History.....166

Science at Work

New Loran Aids Fishermen.....116
Putting a Generator Together.....116
Rescue Boat Built Like Plane.....117
Leak Sniffer Tests Footballs.....128
Hot Rings Test Motor Oil.....133
Porcupine Car Feels Its Way.....136
Port Sweeper Nets Debris.....143
Waste Gas Turns Desert into Garden.....157
Scope "Sees" Invisible Light.....163
Slit-Sheet Veneer Saves Waste.....172

PS Features

Motors Flip Model Town into New Era..138
How Experts Move Big Stuff.....153
You Spring from Morning to Night.....158
Oil-Well Nuisance Becomes Dry Ice.....164
Mechanical Hands Prepare Your Food..169
Asphalt Plant Rides to Job.....173
2-Man Mine Feeds Huge Glass Plant.....174

Aviation

Extra Sense Added to Navy Autopilot....129
Constitution 134
NATIV Trains Rocketeers.....137
Propeller 'Copters Are Funny Birds.....140
What's New in Aviation.....144
DC-3 Brought Up to Date.....147

Automobiles

Double-Duty Sedan Starts Trend.....106
Tires Without Tubes Come into Style....118
Street Has Three Decks.....136
Chrysler Adds a Crash Pad.....148
Station Wagon Is New Size.....163
Bouncer Tests Car-Seat Fabric.....168
Gus Runs into Twin Trouble.....176
How Overdrive Works.....180
Torque Converter Drives Bus.....185
Engine Converts Trailer.....186
Small Tractor Turns in Big Job.....196
Hints from the Model Garage.....204

Inventions

New Ideas from the Inventors.....114
Tractor Attachment Builds Terraces.....132
Springs Support Changing Loads.....162
Platform Speeds Tree Pruning.....163
Motorized Mower Trims Hedges.....168

Continued on page 4

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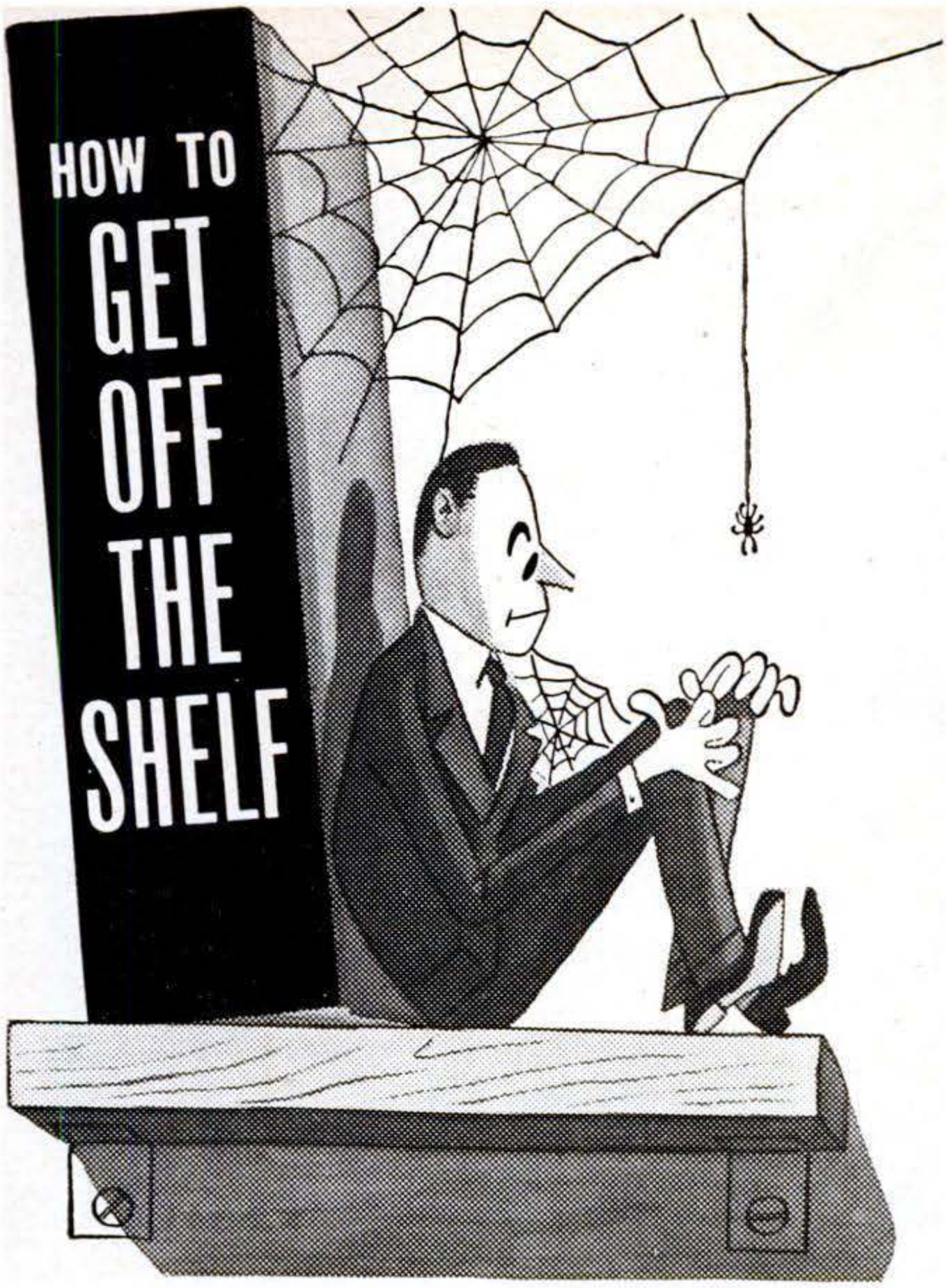

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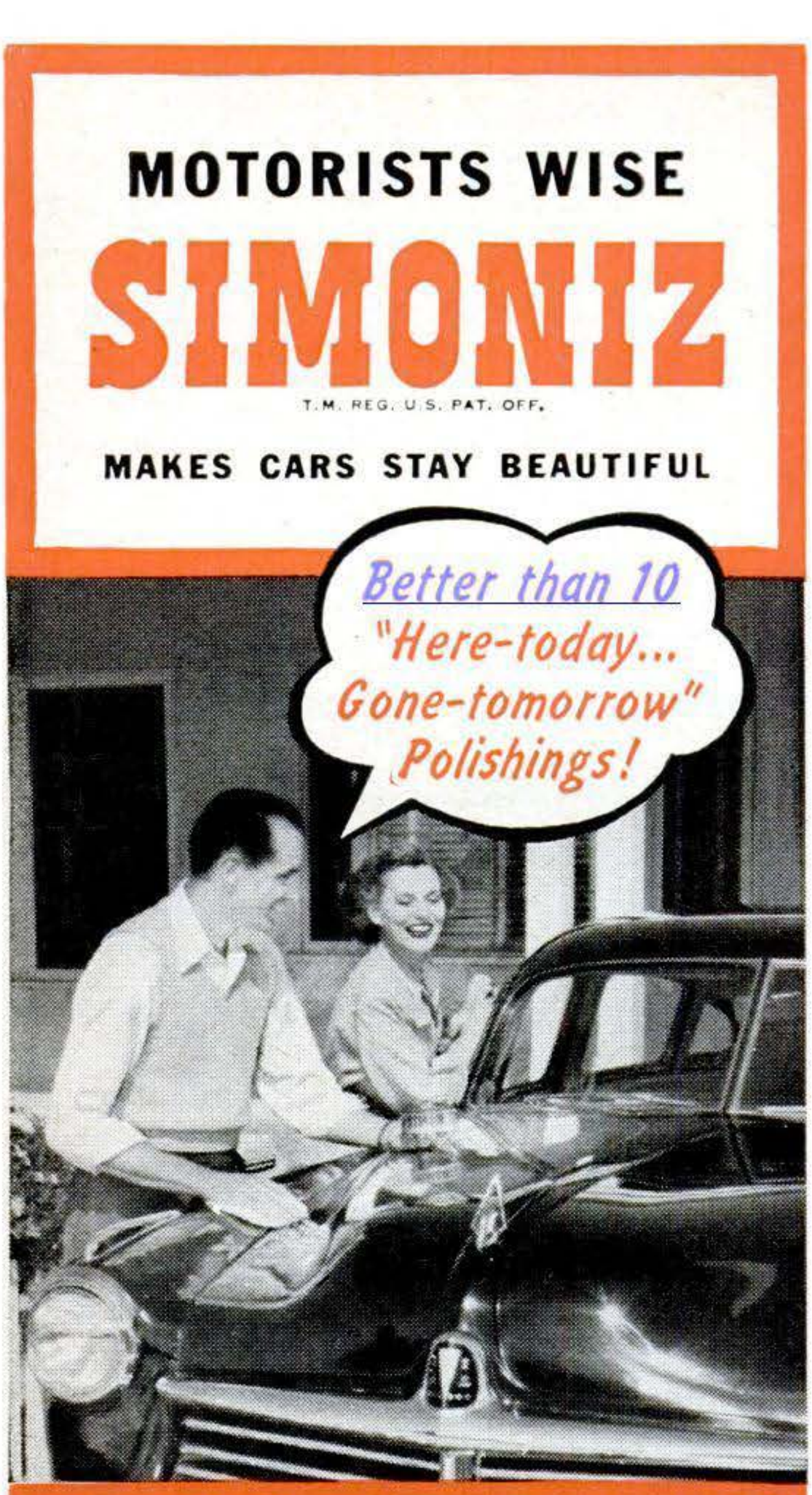

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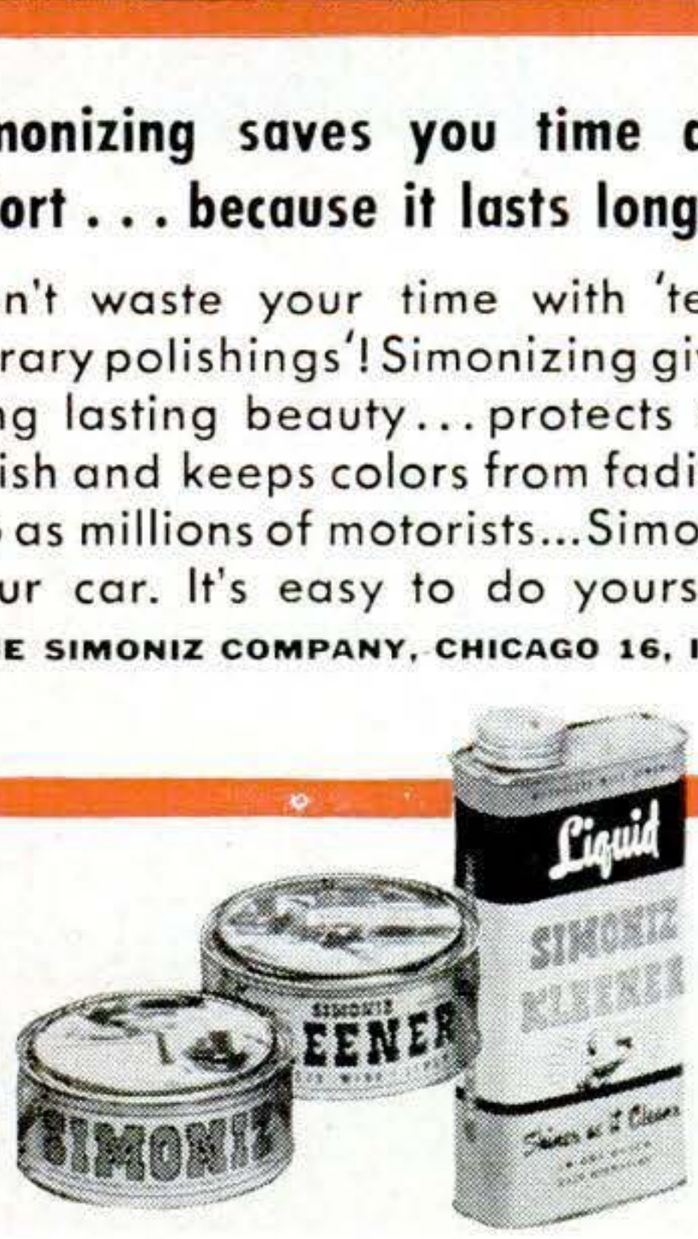

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New Products

New "Iron Lung" Is Portable.....117
Pen Writes at High Altitudes.....163
Squirt Can Douses Fire.....172
Auto Lamp Has Five-Way Switch.....238
Old Razor Blades Trim Grass.....245
Aluminum Strips Scare Pests.....246
Trailer Hitch Is Streamlined.....248

Photography

Type Set Photographically.....133
Basement Den and Darkroom.....220
Stovepipe Case for Movie Reels.....222
How to Revive Faded Photos.....223

Mechanics & Shopwork

Model of Narrow-Gauge Engine.....188
Steel Wool in Drill Polishes Wood.....199
Vacuum-Cleaner Motors Run Tools.....216
Magnet and Motor Regulate Clock.....218
Machines Shape Moldings.....234
Making a Rotary Electric Mower.....242
Bucksaw Frame Cut from Old Cot.....248

Home Mechanics & Handicraft

Horned Toad Decorates Box.....193
Bag Cut from Cowhide.....194
Trolley Feeder Draws Birds.....197
Miniature Bird Whittled from Pine.....198
How to Etch Aluminum.....200
Two-Tone Powder Box of Plastic.....203
There's Magic in Chemistry.....206
Repairing Zippers.....209
Hand Tools Build Modern Table.....211
Thread Forms Guide Lines.....238
Footstool Combines Shine Box.....238
Spray Gun Checks Screen Door.....239
Knot It Right.....240
Reel Stores 100 Feet of Hose.....245
Plastic Spoons Make Lures.....246
New Valve Seats End Faucet Drips.....247

Radio & Electricity

Tape Records Mass-Produced.....113
Meter Tests TV Tubes.....116
New Fins Lighten Radio Tube.....117
Walkie-Talkie Weighs 2½ Lb.....168
I Assembled My TV Set.....226

Departments

Letters 16
I'd Like to See Them Make..... 98
Voice of Science.....103
What's Your Ingenuity Quotient?.....208
New Shop Ideas.....214
New Tools.....219
Photo Ideas and Equipment.....224
Keeping the Home Shipshape.....232
To: Reader—From: Editor.....302

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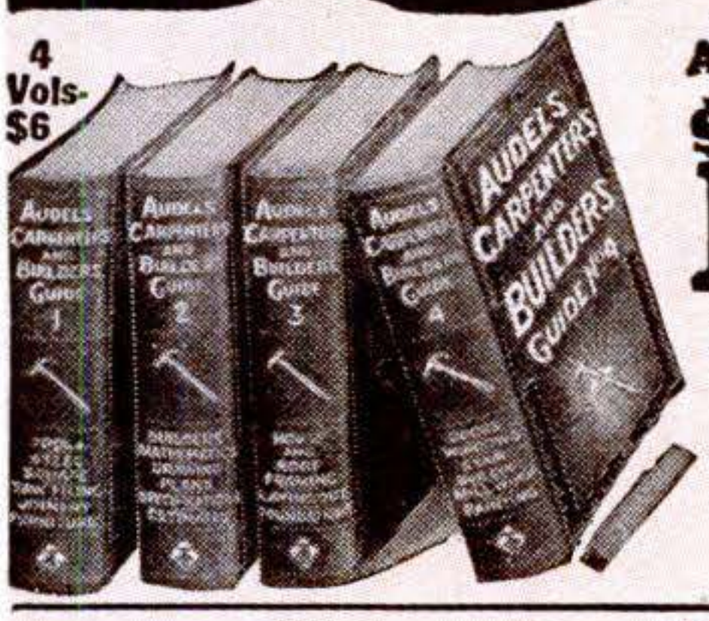

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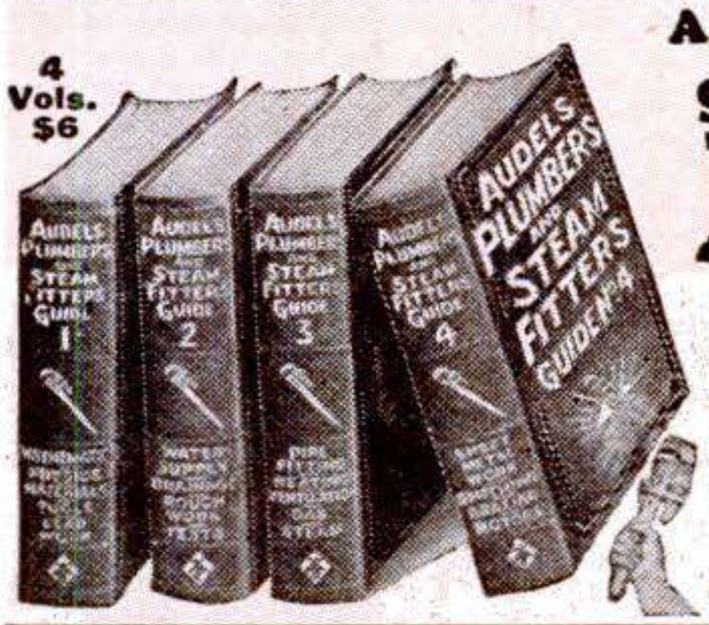

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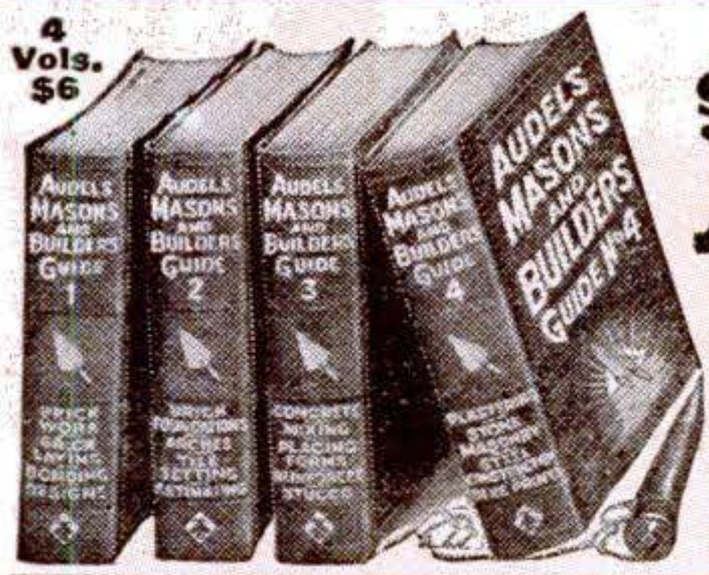

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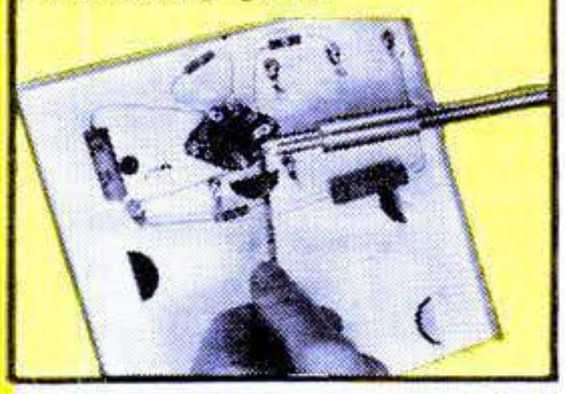

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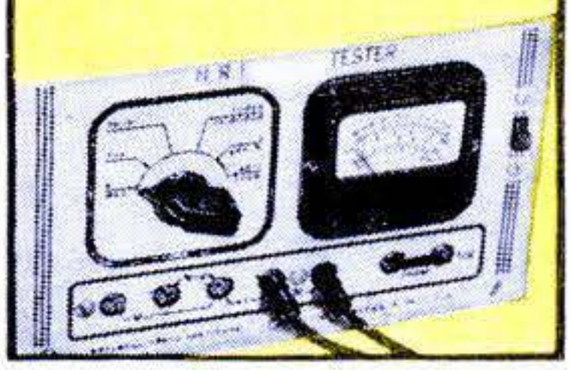

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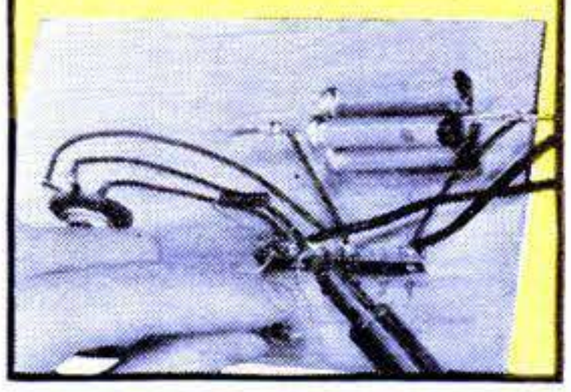

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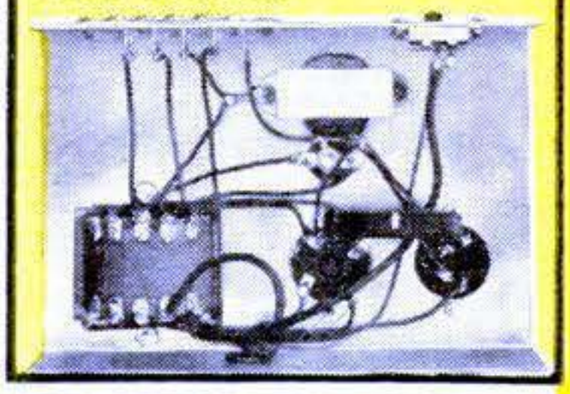

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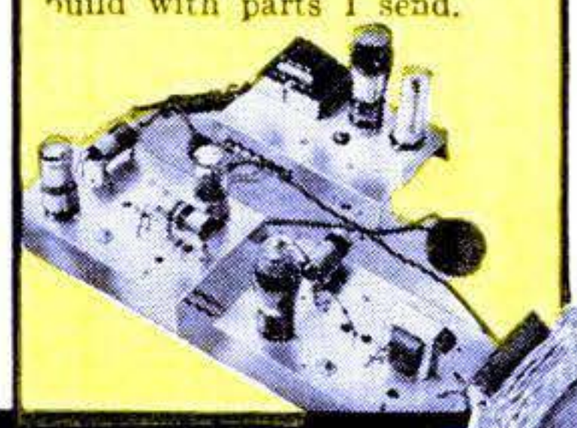

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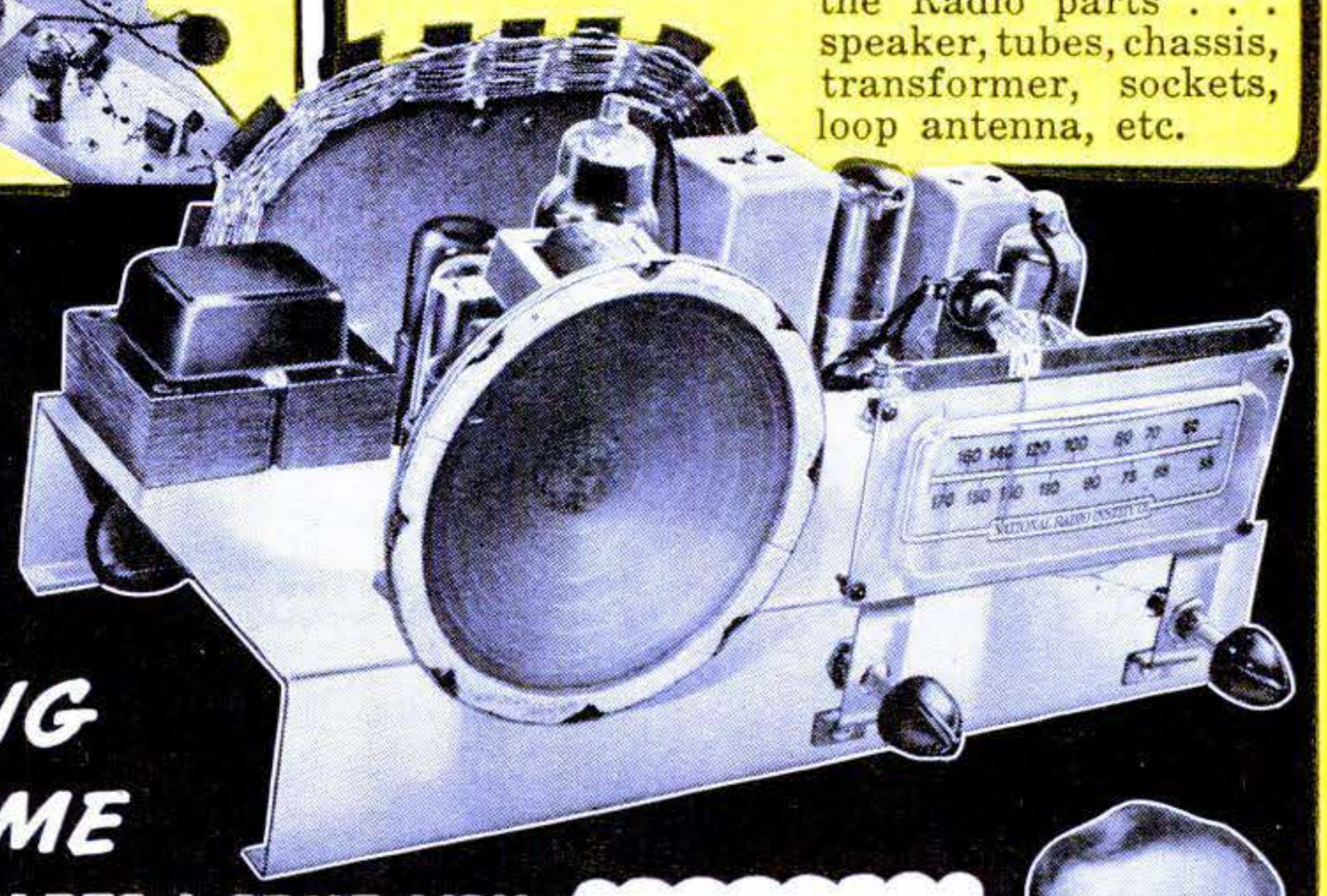

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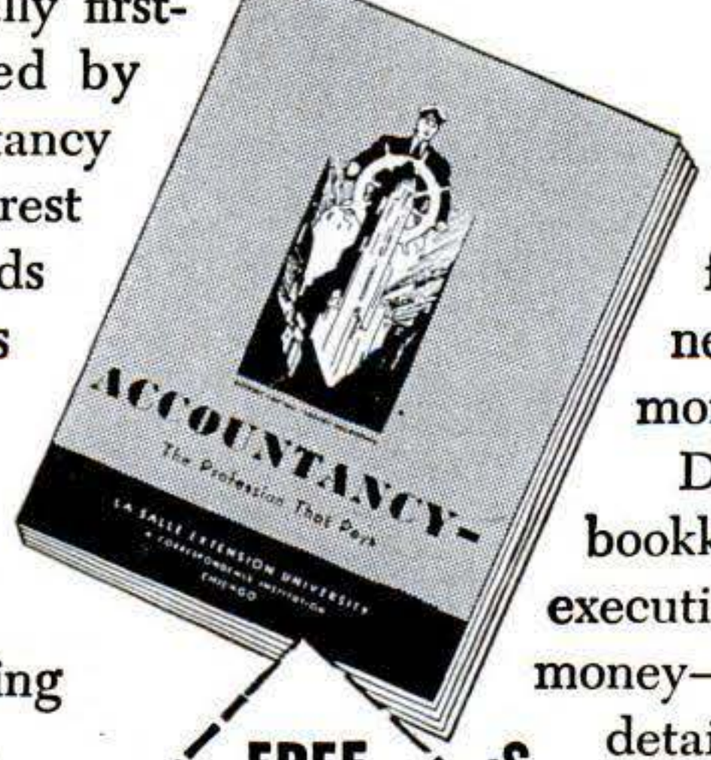

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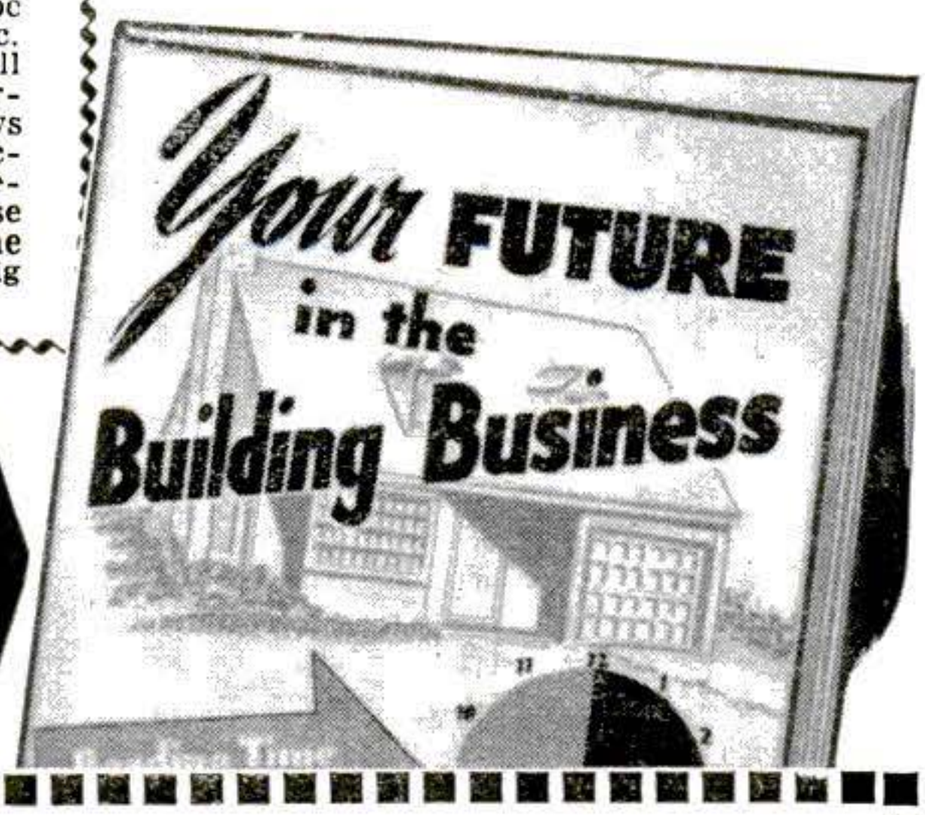

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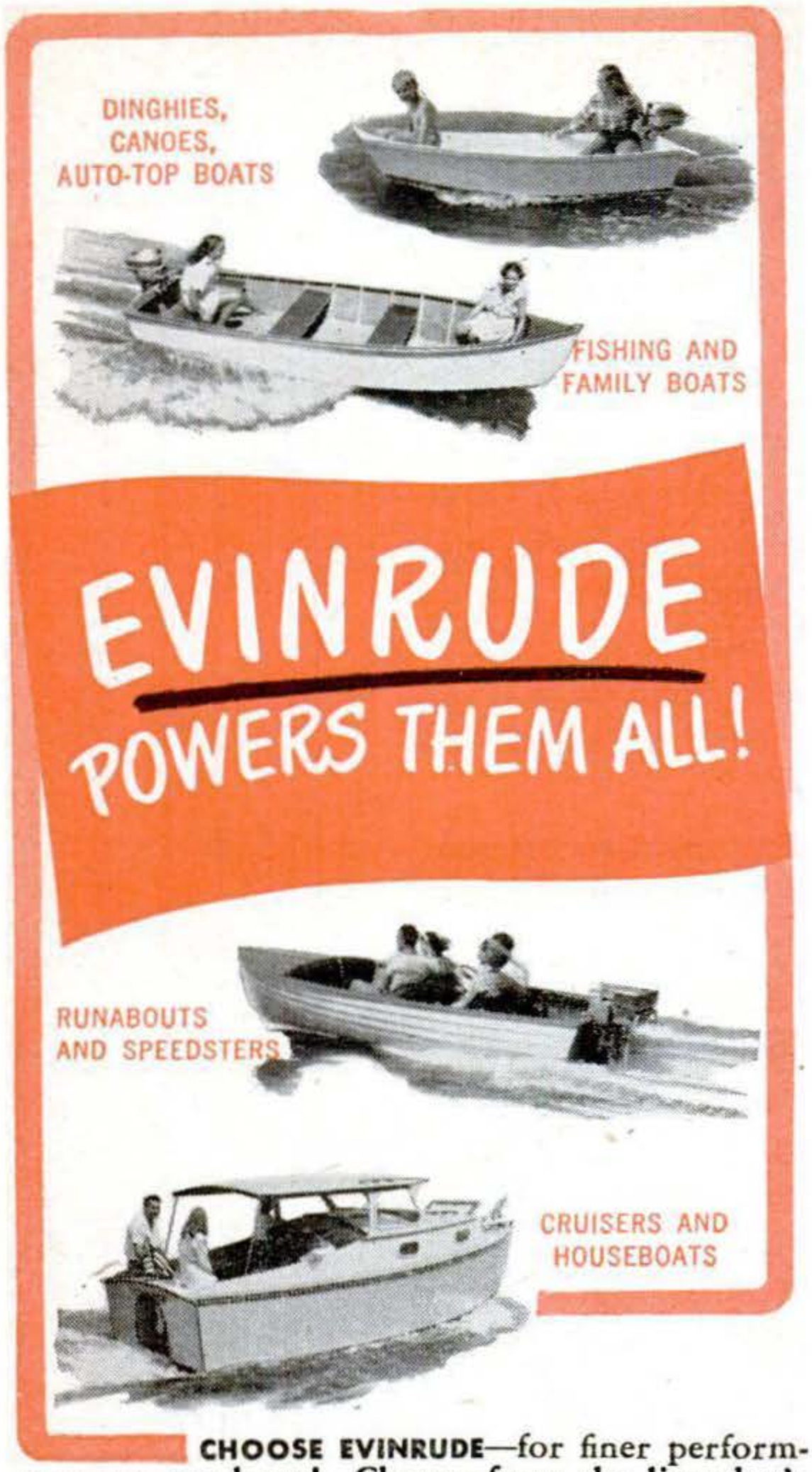

Letters

The Battle of Vivisection

Sir:

"The Truth About Experimental Animals" [PS, Feb. '49, p. 111] is one of the best editorial statements I have seen in a long time.

A. J. Carlson, Ph.D., M.D.
President
National Society for Medical Research
Chicago, Ill.

Sir:

In 1944, while in the Army, I suffered an attack of cerebro-spinal meningitis. Up to that time, the odds against recovery were about 10 to 1. However, under a treatment of sulpha and penicillin, I recovered, with little noticeable after effects.

My family and I are forever grateful to those animals who died that I might live.

Donald P. Holmes
Oakland, Calif.

Sir:

Just for the record, I should like to comment briefly on the editorial in your February number in which it is suggested that anti-vivisectionists find their motivation in the fact that "they hate humans."

I suppose you would be the first to agree that this idea is no more false than the rest of your piece.

I shall not bother to list for you the great minds—from Burbank and Darrow to Louis Bromfield and Mark Twain—differing totally with your point of view. The fact that Twain belongs to the Nineteenth Century cannot mean much, surely—for if animal experimentation has created great good in the past century or so, then surely it must have been more valuable in Twain's day than it is now in terms of what lay before it to be accomplished.

Before a subcommittee of the Wisconsin General Assembly a couple of years ago, Dr. Meek of Wisconsin said this: "No agony is too acute to be visited upon an infinite number of animals if in the opinion of the least member of any medical faculty there is any chance of adding to the sum of human knowledge—and this without reference to the question of whether such addition is

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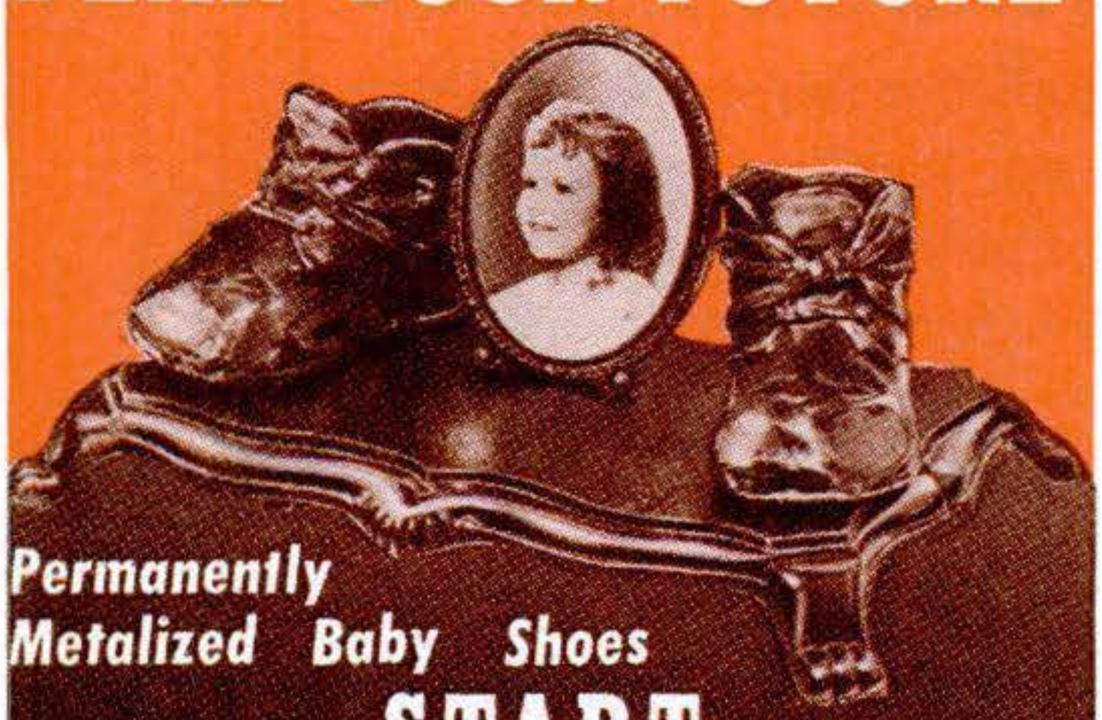

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likely to be of any practical value or not."

It is that attitude, Sir—not the "slaying" of an unborn chick through boiling an egg—which anti-vivisectionists oppose. . . .

The question, then, is why do you, like other proponents of animal experimentation, find it necessary to defend the practice by resort to arguments you know to be false?

C. E. RICHARD
Managing Director
The National Anti-Vivisection Society
Chicago, Ill.

Sir:

I have been bitterly opposed to the cruelties of vivisection upon dogs from knowing what suffering they have to endure in the vivisection laboratories. . . . I have affidavits from persons who have witnessed this cruelty.

When the public is enlightened on what actually happens to our dogs in the laboratories and that most of the time the dogs are not given any anesthetic, they will compel our legislature to enact a bill outlawing this useless form of cruelty. . . .

JAMES H. CRUIKSHANK
New York, N. Y.

Sir:

I am definitely not an anti-vivisectionist, but I am dotingly fond of my dog whose company I have enjoyed for fifteen years.

Today that dog is very ill, and I have been advised to have her destroyed in a humane manner. Such a decision is hard for me to make, and since reading your editorial, I feel much better about it all. A "chicken heart" is detrimental although understandable in cases of dog-lovers for their own pets to whom they have become attached, but to carry over such obviously foolish love to every dog so as to interfere with the science of life and its ever-present mysteries is an unpardonable sin.

I heartily agree with you, Mr. Githens, and I extend you my deepest respect for all your wisdom editorially rendered.

JACK SKALICKY
Cedar Rapids, Ia.

Sir:

We happen to be two of the crazy people this Githens refers to, but it also happens we know a great deal about some of these experiments and a great deal more about the subject than he. . . .

We are just crazy enough to cancel our

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ADVICE FOR THE INVENTOR

Unless an inventor is thoroughly familiar with such matters, he is advised to employ a competent registered patent attorney or agent as the value of patents depends largely upon the skillful preparation of the specification and claims.

For his guidance, the following are the usual preliminary steps which the inventor takes toward patent protection.

The "Evidence of Invention" form mentioned below is offered as a convenience to the inventor in making his disclosure of invention.

The inventor should date and sign his disclosure and have it witnessed by two or more persons who are capable of understanding his invention. The disclosure should then be mailed to the registered patent attorney or agent whom he selects to assist him. The disclosure should be accompanied by a letter authorizing the patent attorney or agent to conduct a preliminary search among previously granted U. S. patents for similar types of invention. The patent attorney or agent then prepares a report of the probable patentability of the invention and recommends the further course the inventor should take, provided the report indicates possible patentability.

This firm is registered to practice before the U. S. Patent Office and is available to assist inventors in the preparation and prosecution of their cases. The coupon below is suggested as a convenience to the inventor in starting action on his invention.

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subscription to your magazine. The remaining copies, which unfortunately are paid for, can be sent to some used paper dealer, but don't send us any more, ever.

MRS. FRANCIS PERRY

Chicago, Ill.

Sir:

I am a dog lover, but I say "bravo" for writing the article, "The Truth About Experimental Animals." It is shameful that in this country, and in this age, we allow science to be seriously hampered by a powerful organization of "sick people," so-called lovers of dogs.

EDNA M. DUBUIS

Bar Harbor, Me.

Sir:

My husband has been a chronic reader of your magazine for many years, but after reading your personal plug for an article upholding vivisection, he says he is through with it for good. Not that we are anti-vivisectionists. We heartily approve of it for those who commit rape and murder, all Communists and quite a few New Dealers.

This damnable outrage against helpless animals will be outlawed one of these days regardless of how many "blue babies" turn a deeper indigo. Better that they turn blue than grow up and turn yellow, championing such a cowardly, cruel thing as vivisection.

MRS. VERNON STONE

Roosevelt, N. Y.

Sir:

This is an idea I've had for some time as to how we may combat the menace of anti-vivisectionists. Children just naturally love animals, and they should see educational movies showing how humanely the doctors and laboratories treat their little furry friends and how they are indeed a friend to man by saving so many people's lives . . .

An educated public will start with an educated school child. . . .

SARA ORTGIER

Bell, Calif.

Everything's Up to Date in Denmark

Sir:

In the December issue, in the column "I'd Like to See Them Make" on page 165, Mr. H. M. Hartery would like to see them make a "coin-operated electric shaver." At-

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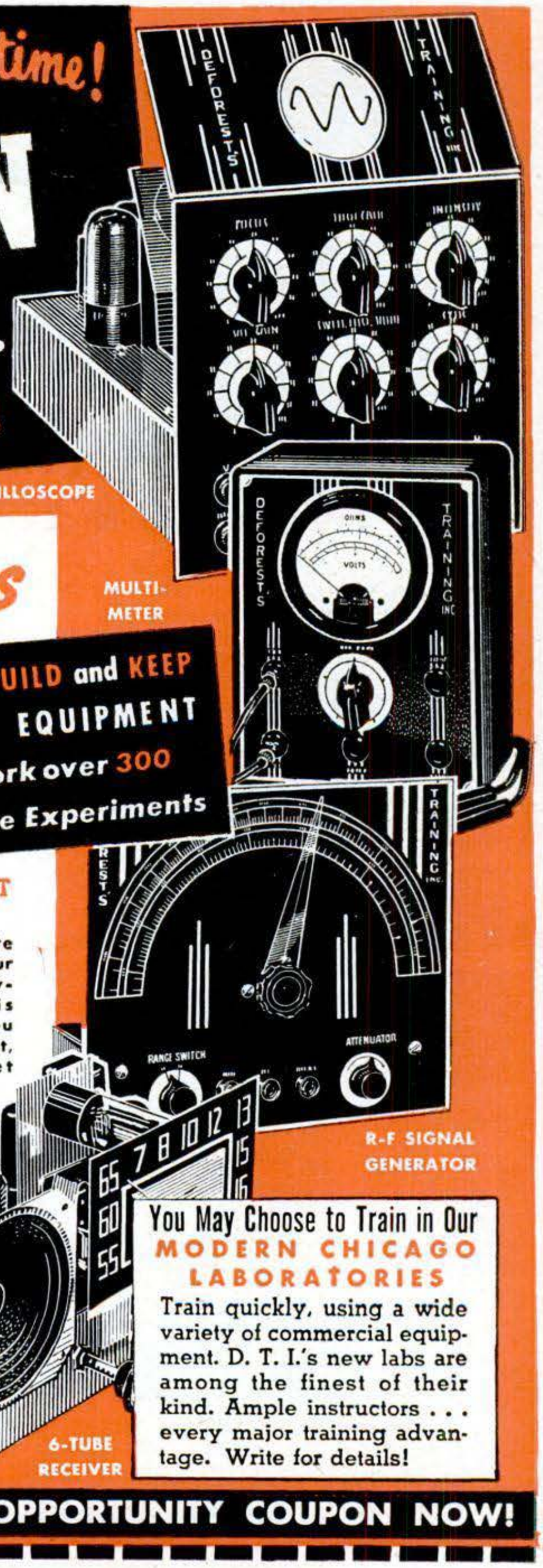

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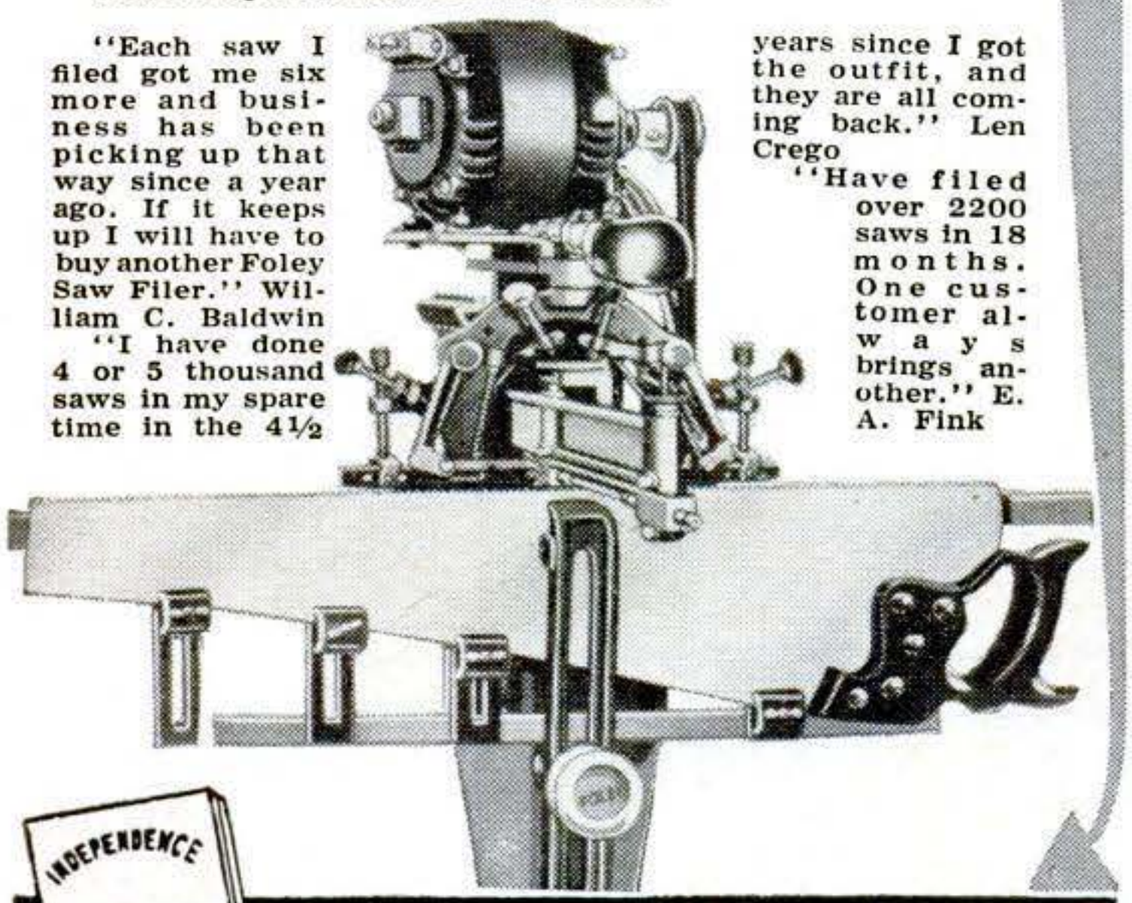
"Have filed over 2200 saws in 18 months. One customer always brings another." E. A. Fink



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tention Mr. Hartery—just move to Copenhagen. At the Central Railway Station you can try one of them. They have been there for more than a year.

In an old issue, I've seen that somebody would like to see a coin-operated typewriter. In the same station there is also one of these. It has been there for many years.

So, you see, we are not very far behind in Copenhagen! . . .

GUNNAR MORTENSEN
Copenhagen, Denmark

Jack-of-All-Trades Horsepower?

Sir:

The article on page 156 of the December issue, "How to get along when the power goes off," gave me an idea you may be interested in. It is using one motor for several jobs, and although the subject is often brought up in conversation among farmers, the farm machinery companies have never suggested it.

Many farmers have equipment that has a large motor, and they use this motor only two to four weeks a year. For example, the motor on the combine, hay-baler, corn picker, and field chopper. Why can't they buy just one motor and change it to the various pieces of machinery as the season progresses? And then they could also use it in the winter on the hammer mill or corn sheller. . . .

RICHARD HABY
St. Louis, Mo.

Count Those Hairs

Sir:

In your excellent cover of the February issue I noticed one glaring inaccuracy. After considerable difficulty I ascertained that your illustration shows only 205 lines instead of the actual 525 found on the television picture.

Tut! and tut again Sirs!

ROBERT J. BECKER, JR.
Kirkwood, Mo.

Tuts to you, too. Didn't you also notice that the man's eyebrow has two hairs too many! Seriously, however, no picture printed in two dimensions can be more than a representation of the original object. Since it would have been impossible to reproduce all 525 lines, we simply used a special half-tone screen to get the effect of television.

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A motor vehicle is a machine of many parts, each part designed and constructed for its own special function.
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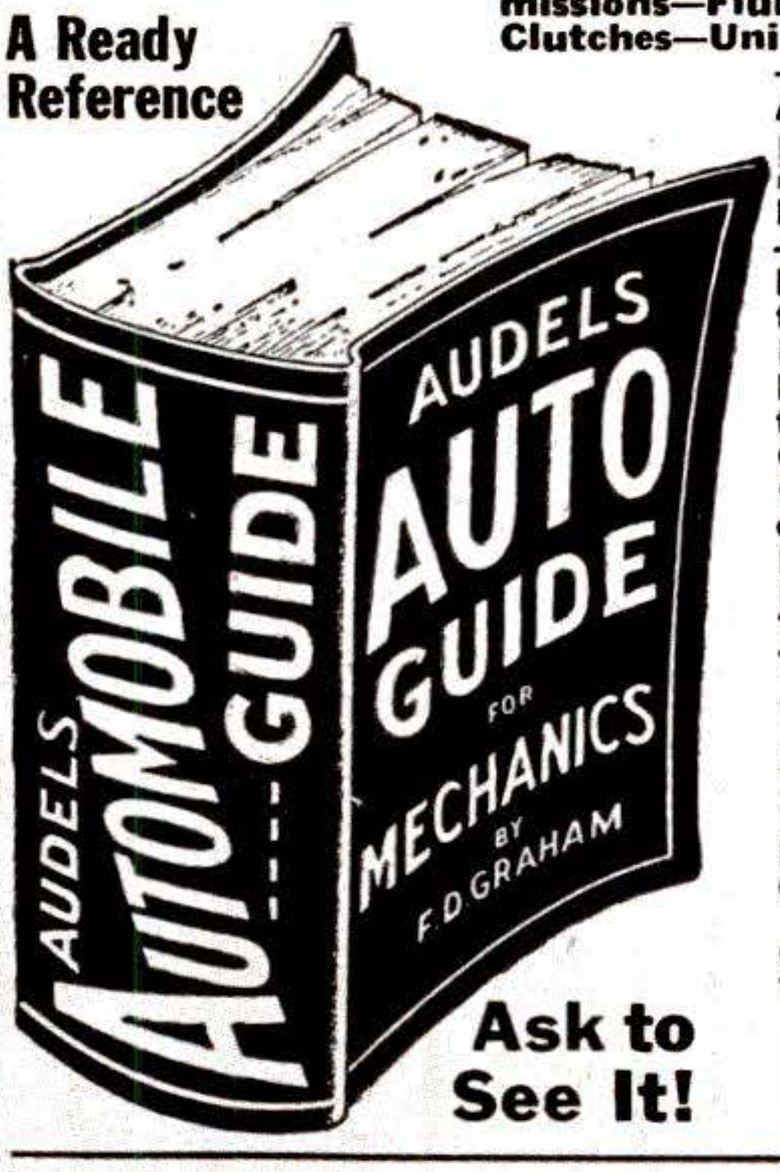

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If your face is broken-out, if bad skin is making you miserable, here is how to stop worrying about pimples, blackheads and other externally-caused skin troubles.

JUST FOLLOW SKIN DOCTOR'S SIMPLE DIRECTIONS

IT DOESN'T PAY to put up with a broken-out face. Your very success in business, love and social life may depend upon your looks. *Handsomeness and a good appearance usually start with the condition of your skin.* Nobody likes to look at a face that is blemished by blackheads or pimples. WOMEN ARE ATTRACTED TO MEN WHO HAVE SMOOTH, CLEAR, HEALTHY-LOOKING SKIN. Business executives don't choose men whose complexions are against them. Don't take chances with your success in life when this inexpensive Viderm formula may help you

Good-looking Skin Is Not for Women Only

You—*yes, you*—can have the same handsome complexion, free from externally caused skin troubles, simply by giving your face the special care that screen stars give theirs. There's almost nothing to it—it is just about as easy as washing your face. *The whole secret consists of washing your face in a way that thoroughly purges the pores of every last speck of dirt and grime*—something that ordinary cleansing seldom does. In fact, examination after examination shows that, usually, it is not a case of "bad skin" so much as a case of faulty cleansing. What you should use is a highly concentrated soap like Viderm Skin Cleanser. This penetrates the pores and acts as an antiseptic. Specks of irritating dirt and grime are quickly washed out. They dissolve and disappear, leaving your skin entirely free of the dirt particles that usually bring out pimples, blackheads and other externally-caused skin troubles.

DON'T DO THIS!

Don't murder your skin by squeezing it. Skin is delicate. When you break it, you leave yourself open to miseries. It's far easier, far safer, to let the Double Viderm Treatment help you enjoy a handsome, clearer, blemish-free complexion

Squeezing pimples or blackheads to get rid of them is a nasty, messy business—but that isn't the worst of it. Doing so may also be injurious and leave your face with unsightly, embarrassing blemishes. There is, now, a much easier, safer, cleaner way to help you rid your face of ugly, offensive, externally-caused skin troubles. *You merely follow a doctor's simple directions*

Don't murder your skin! Here's all you have to do to get it smoother and clearer and to keep it that way. Use Viderm Skin Cleanser when you wash your face. Rub the rich lather of this highly-concentrated medicated soap on your face for just a few seconds and then rinse it off. Then apply a little Viderm Medicated Skin Cream and that's all there is to it. Viderm Medicated Skin Cream quickly disappears, leaving your skin nice and smooth. This simple treatment, used after shaving, helps heal tiny nicks and cuts, relieves razor-burn and smarting, besides conditioning your skin.

Give Your Face This Treat for 7 Days

Stop worrying and being embarrassed over what may happen to your skin. Just send for your Viderm Double Treatment this minute, and be confident of a smoother and clearer complexion. Follow the simple directions, written by a doctor, that you will get with your Viderm Double Treatment. Then look in your mirror and listen to your friends admire your smoother, clearer skin—the kind that women go for

Just mail your name and address to The New York Skin Laboratory, 206 Division Street, Dept. N, New York City 2, N. Y. By return mail you will receive both of the Viderm formulas, complete with full directions, and mailed in a plain wrapper. On delivery, pay two dollars plus postage. If you wish, you can save the postage fee by mailing the two dollars with your letter. Then, if you aren't thrilled with results, your money will be cheerfully refunded. Remember that both of the formulas you use have been fully tested and proven, and are reliable for you. *If they don't help you, your treatments cost you nothing.* After you have received your Viderm, if you have any questions to ask concerning abused skin, just send them in

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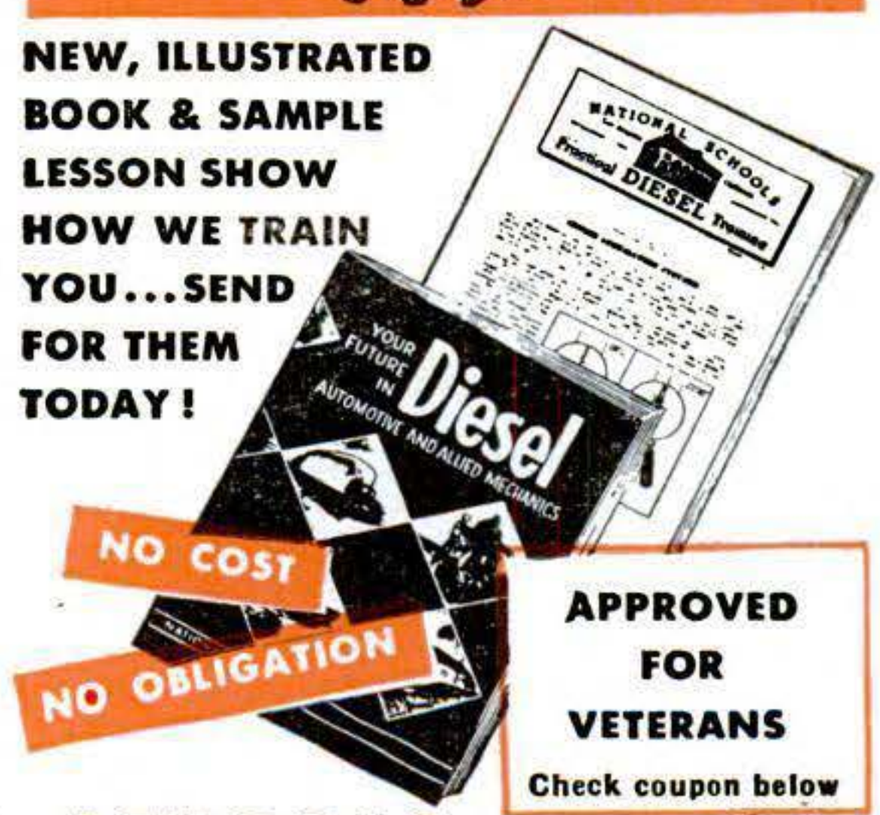

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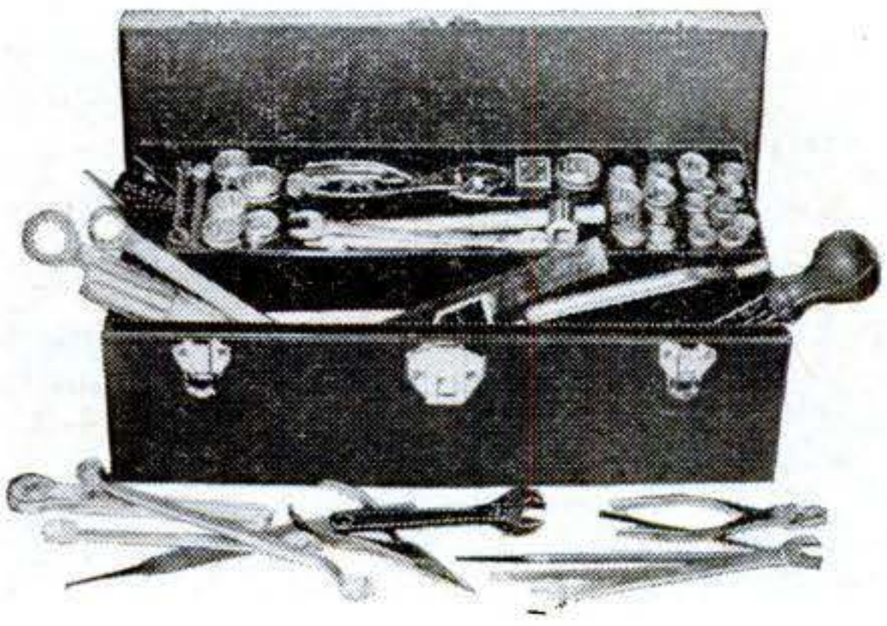

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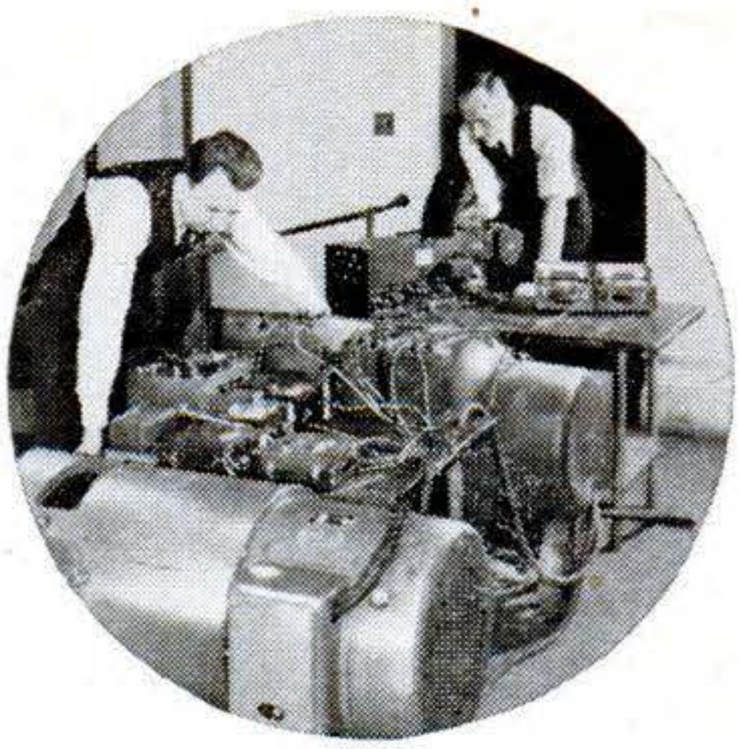

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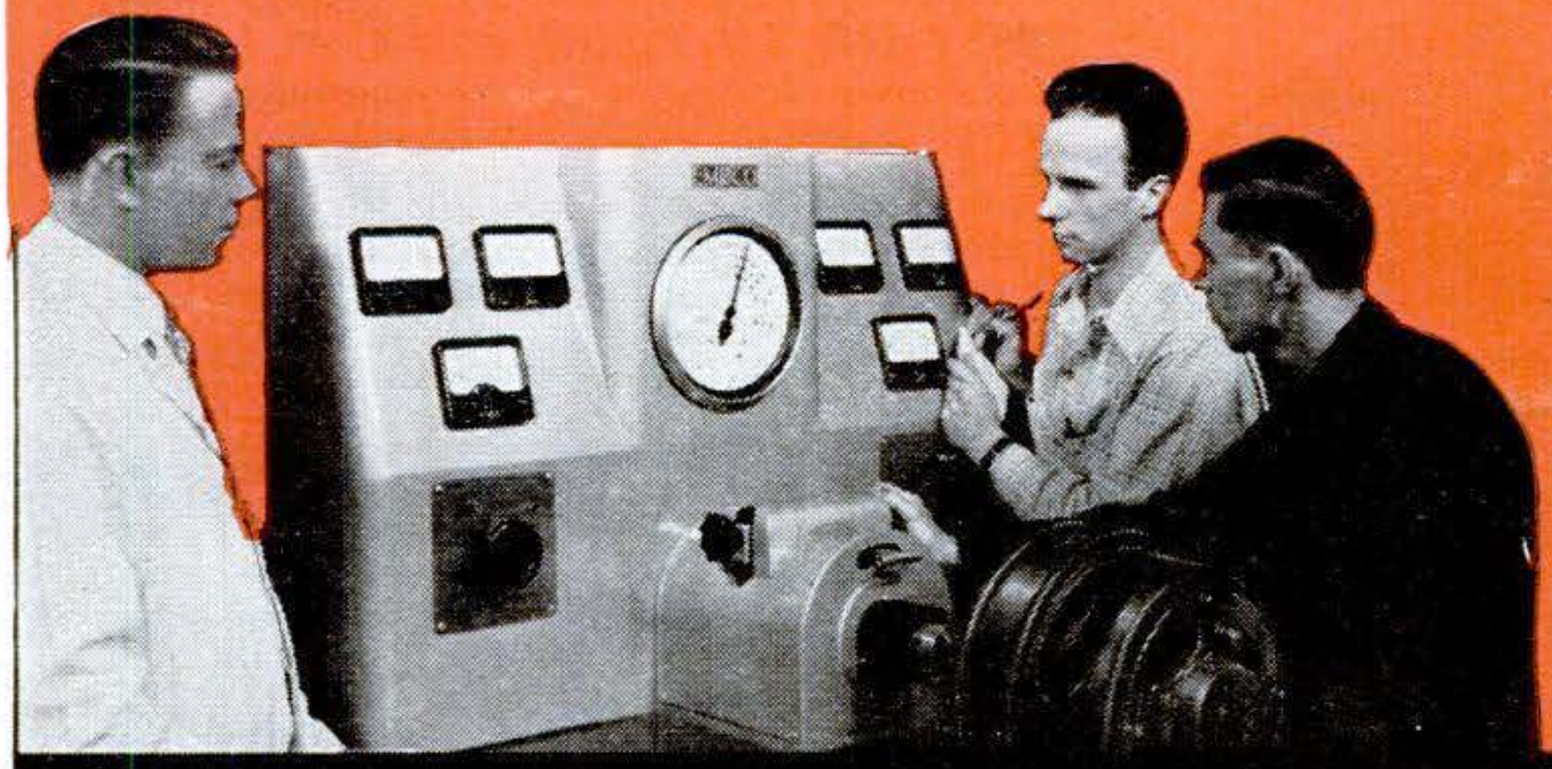

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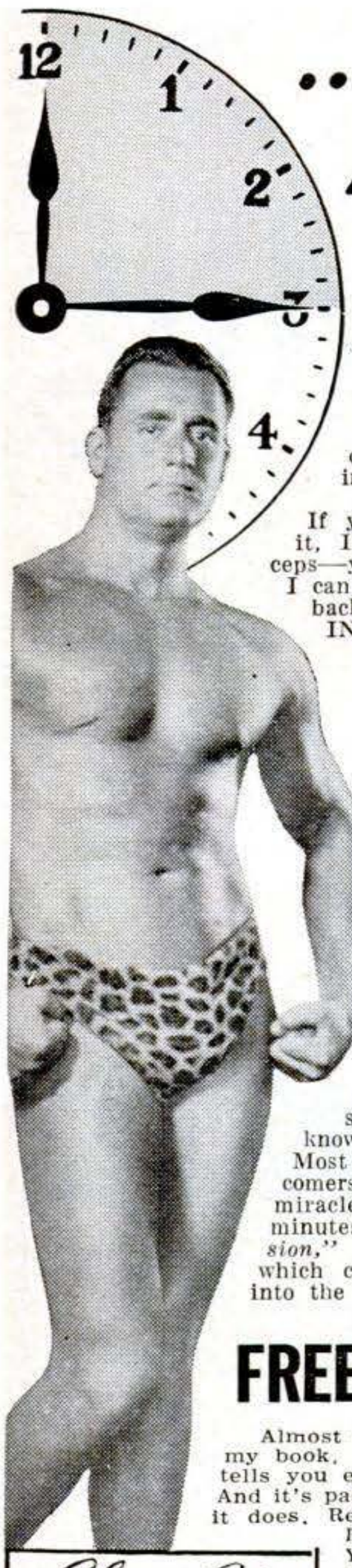

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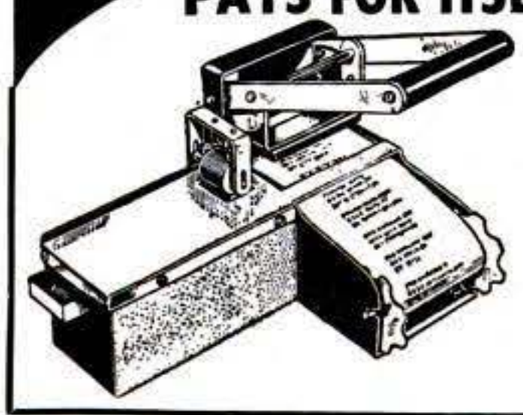

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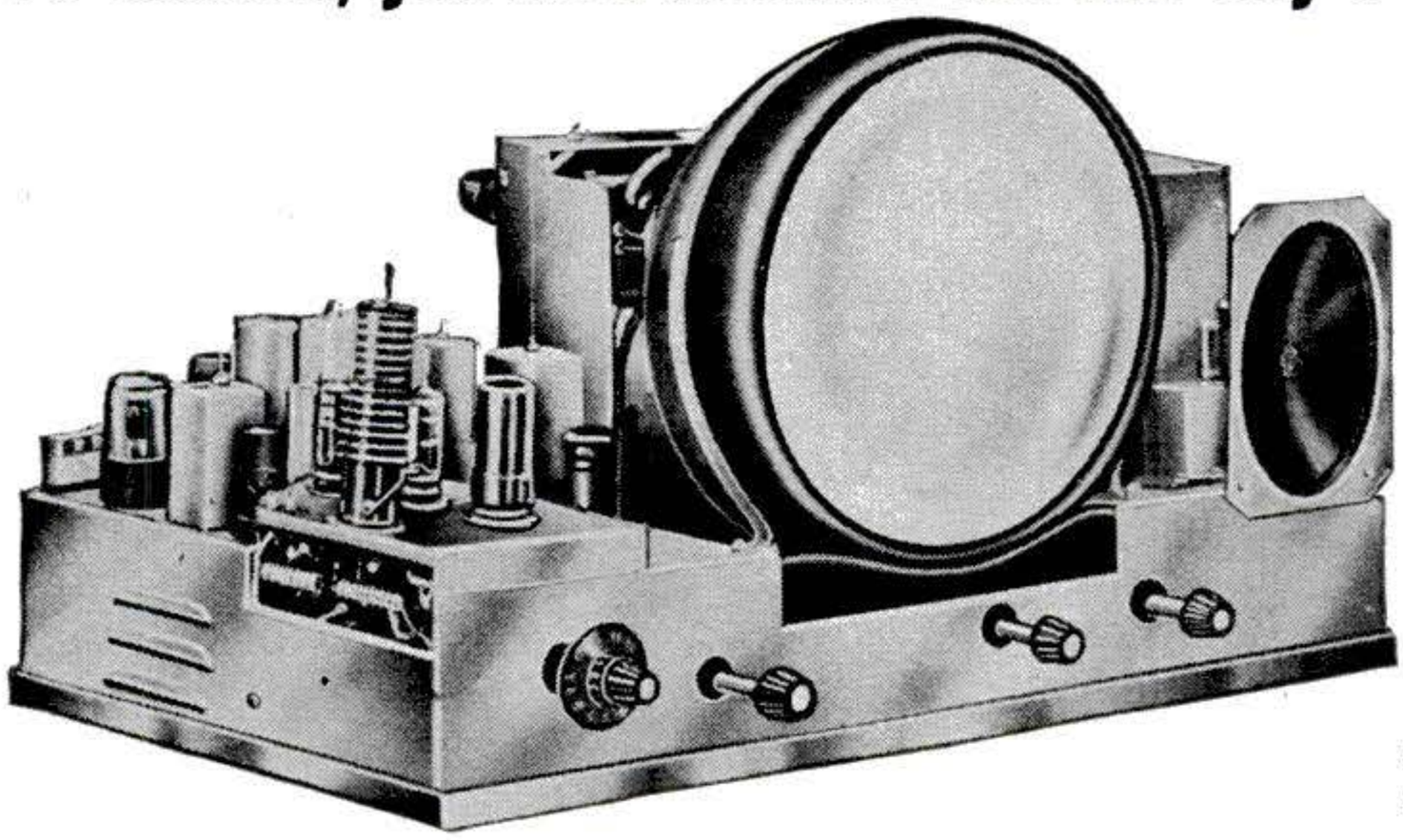

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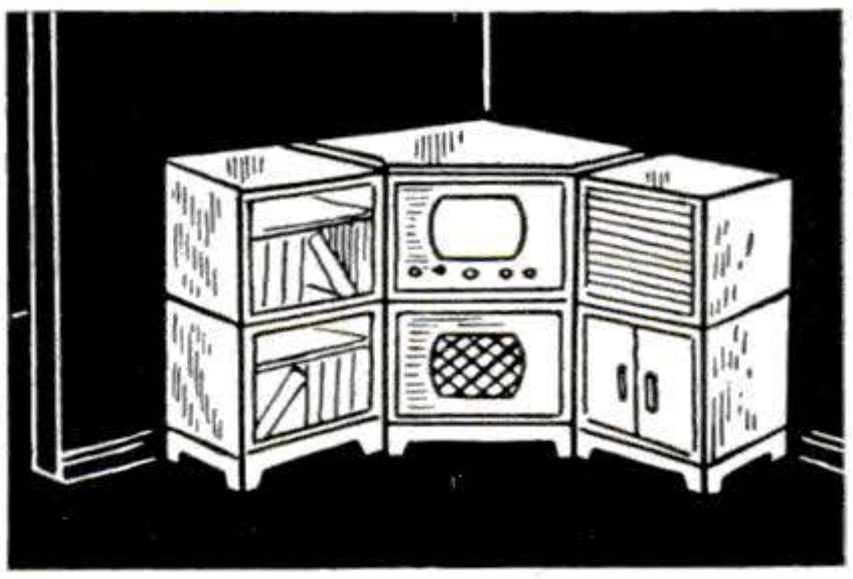

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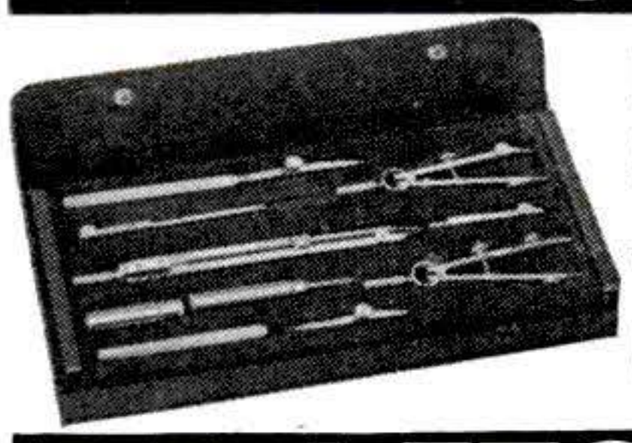

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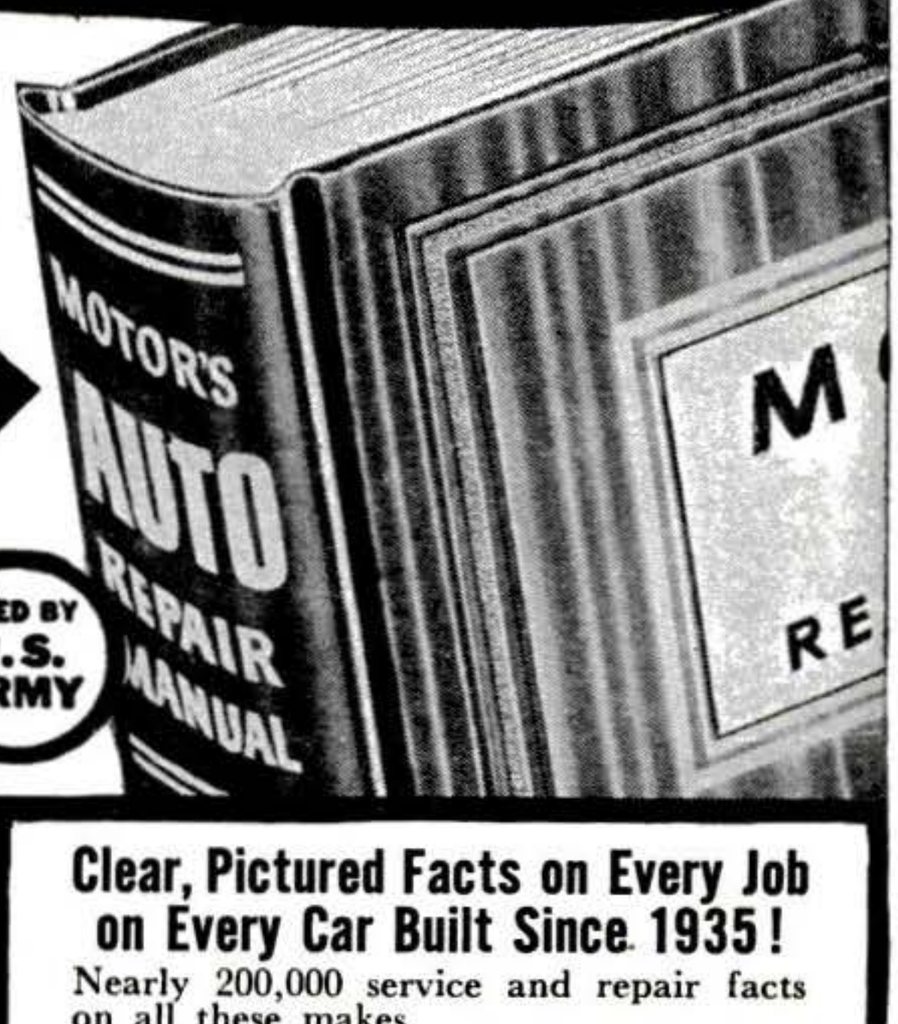

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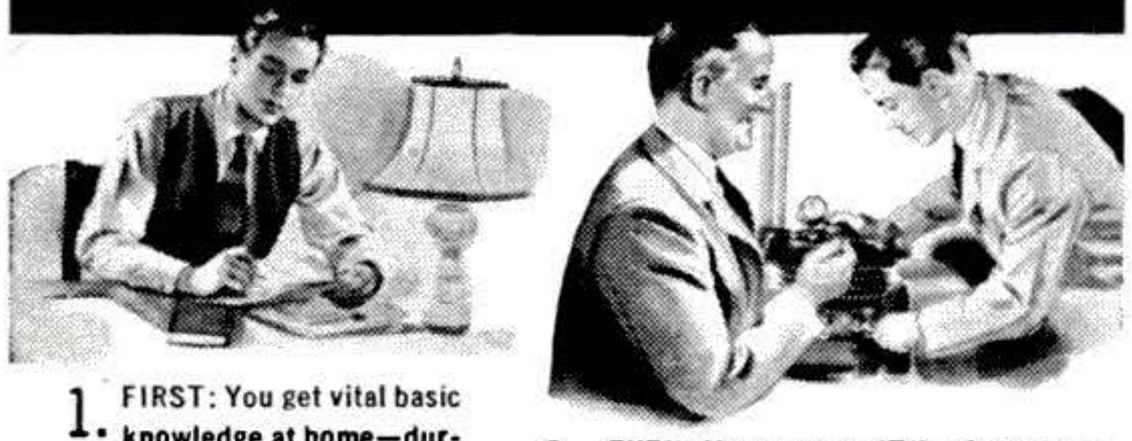

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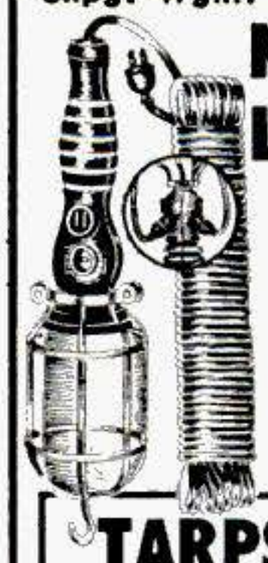

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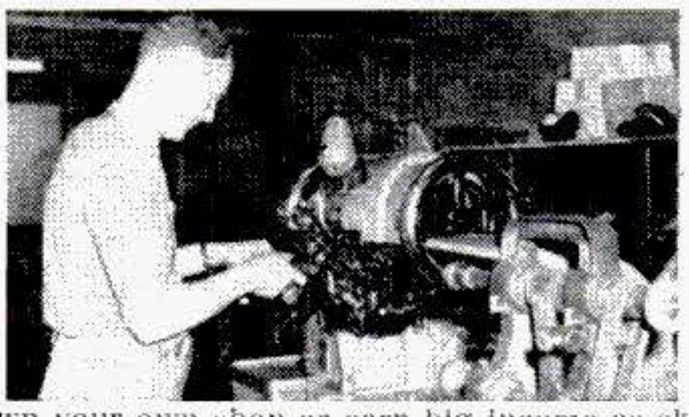

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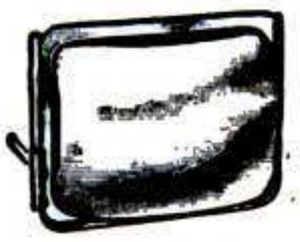

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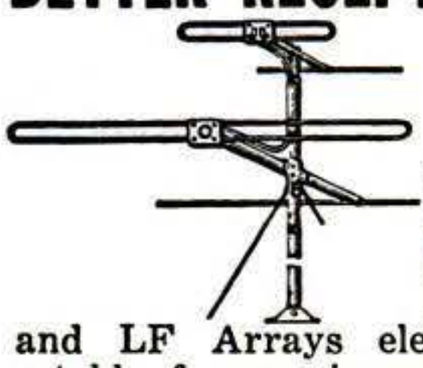

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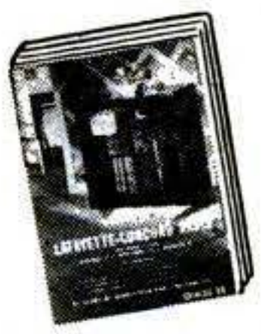

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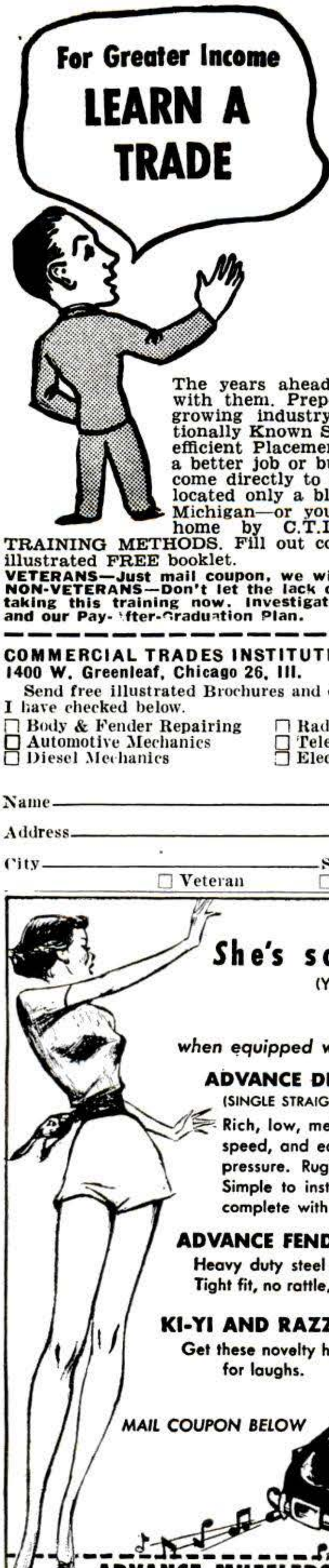

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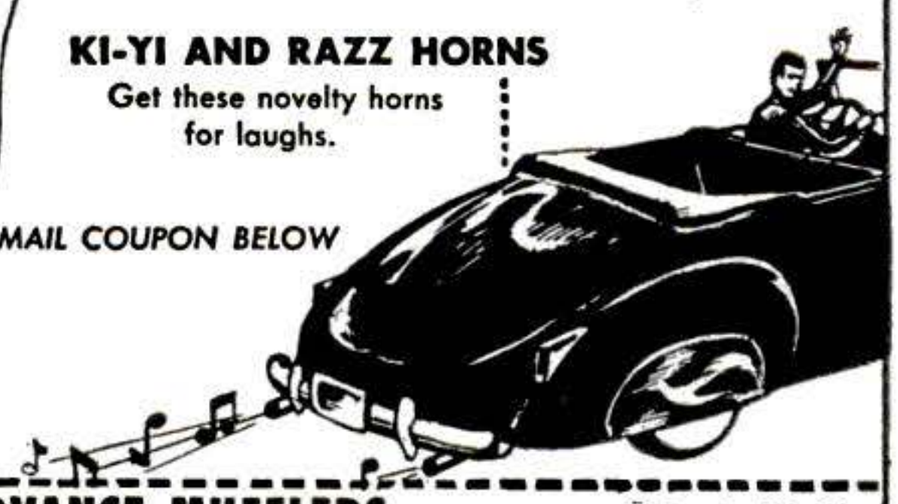

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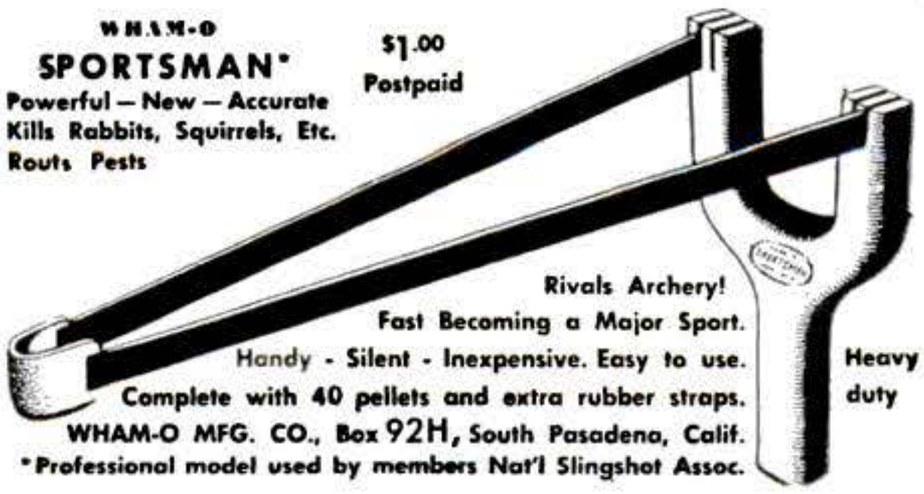

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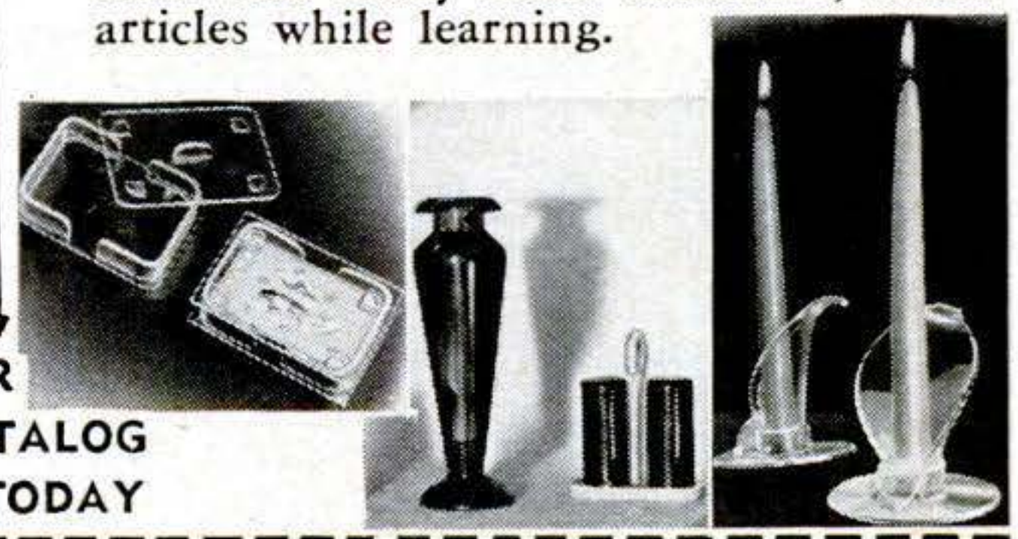

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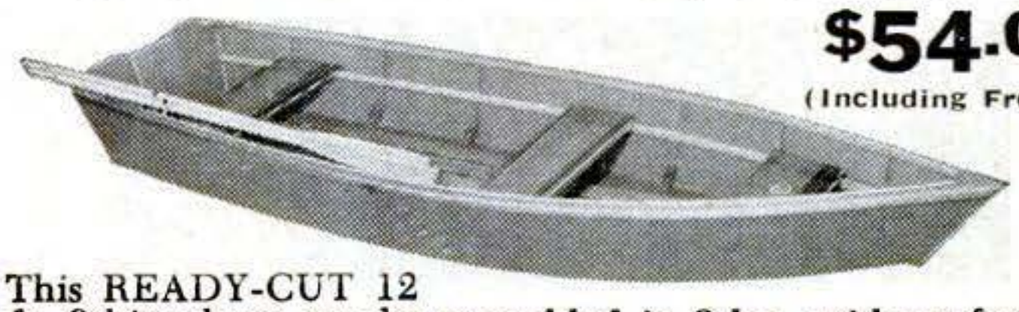

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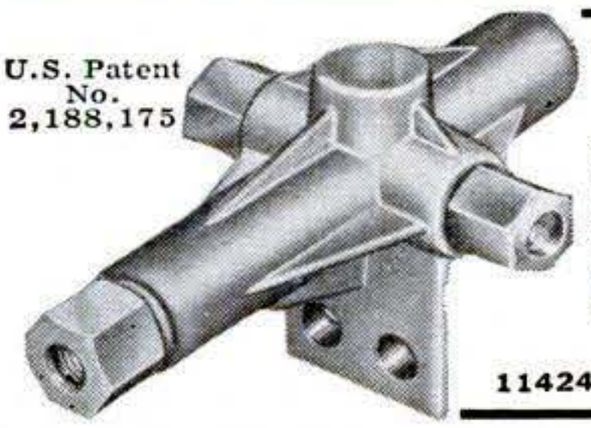

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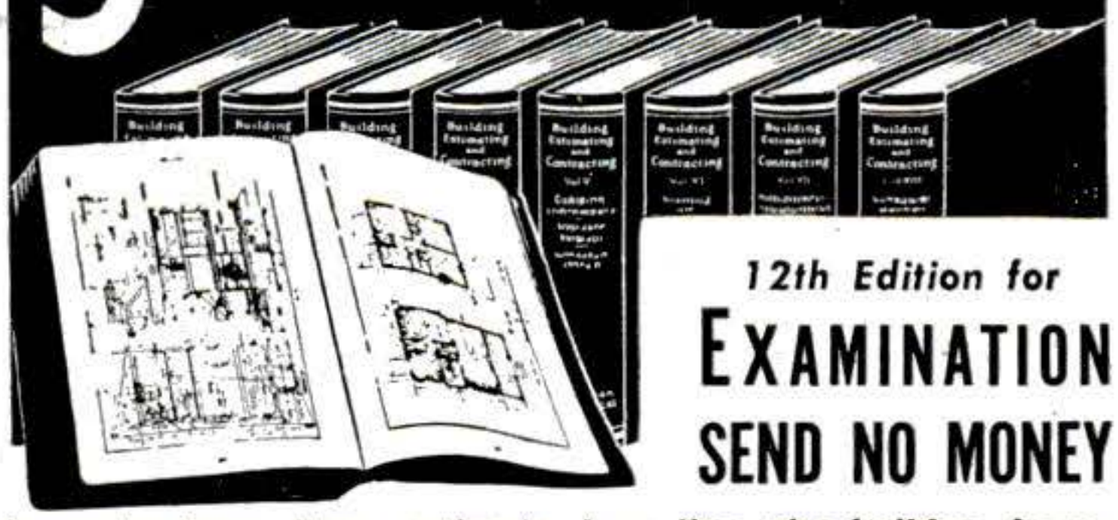

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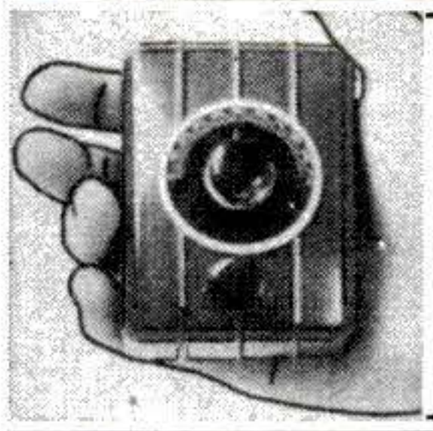

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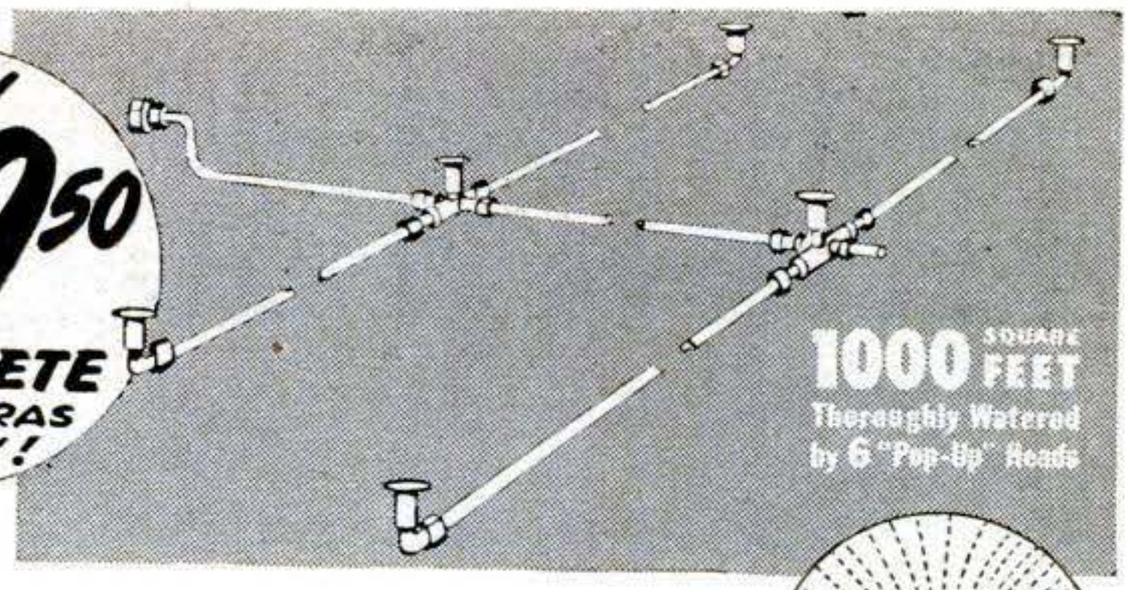

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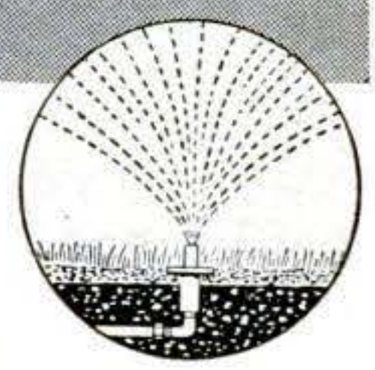

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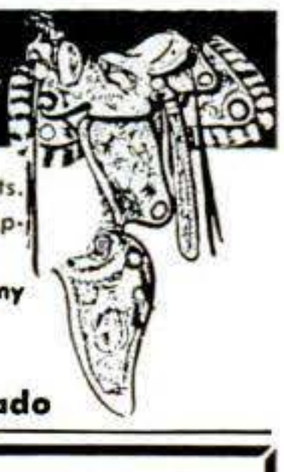

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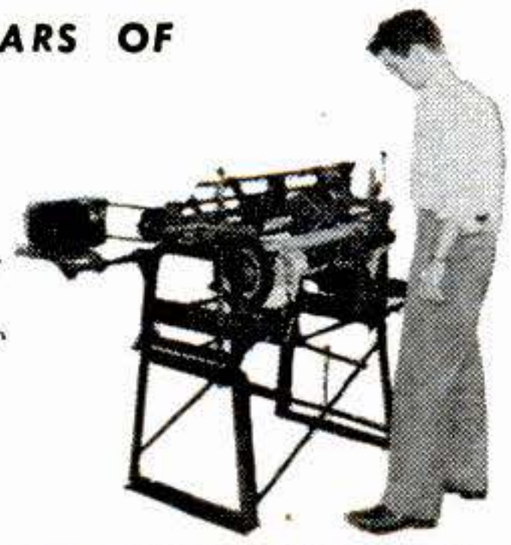

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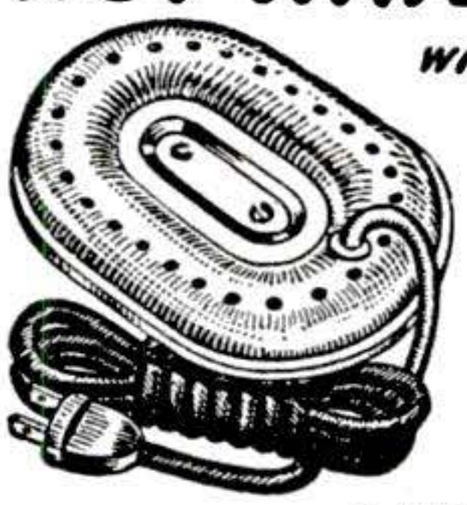

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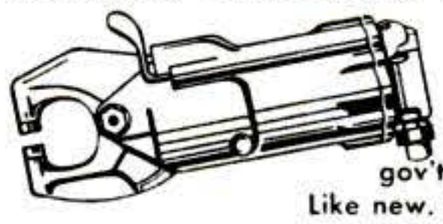

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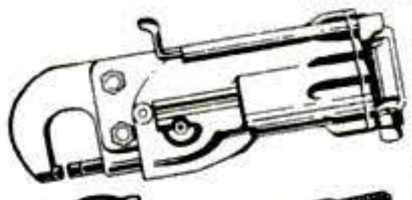

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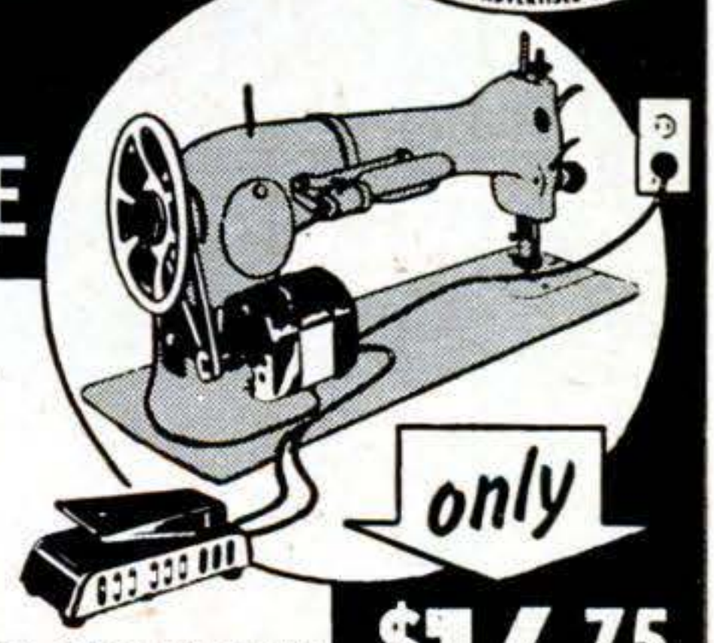

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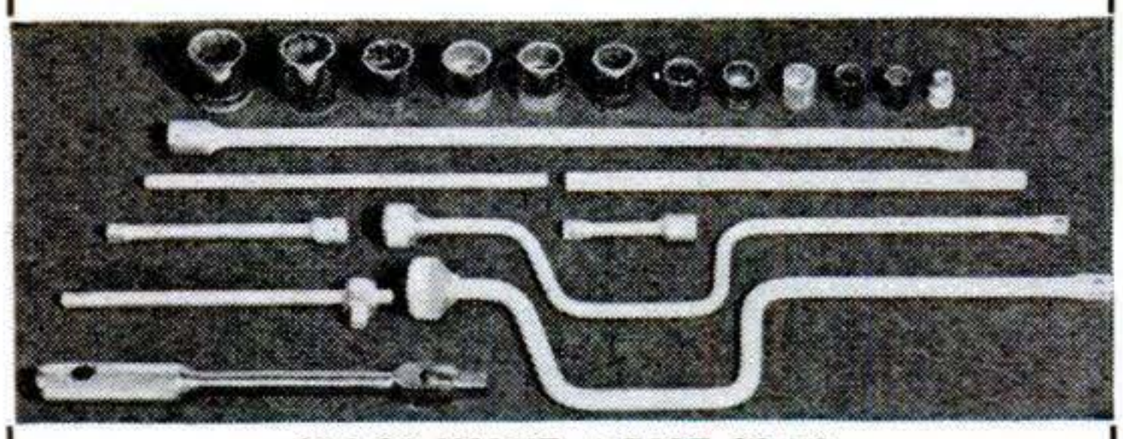

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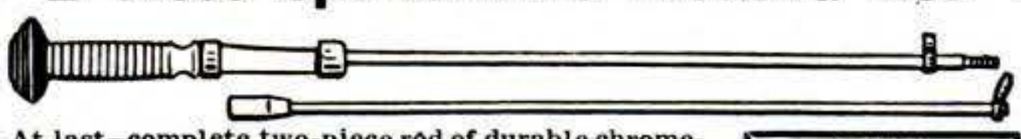

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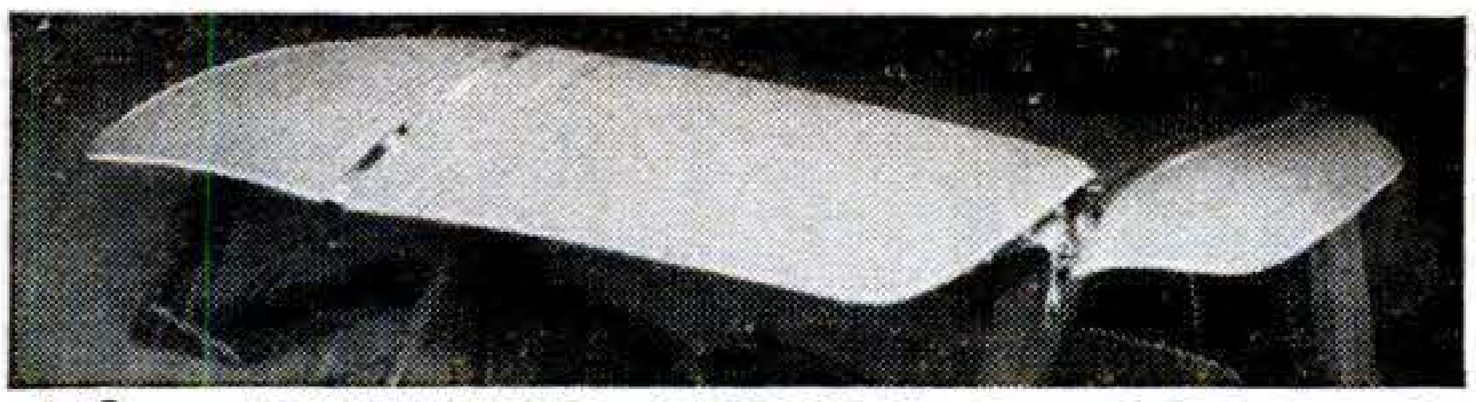

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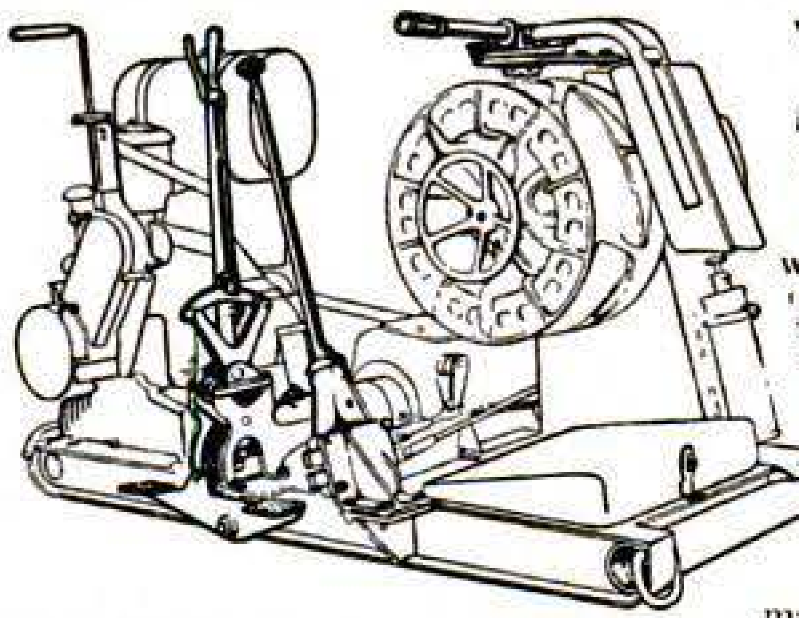

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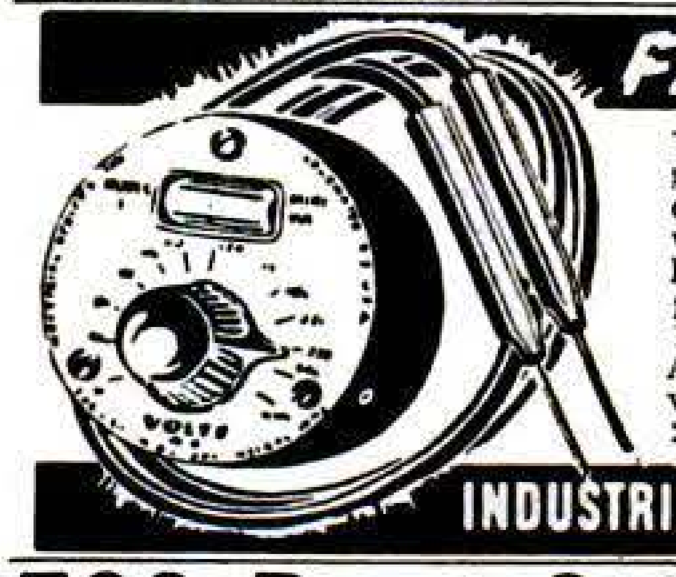

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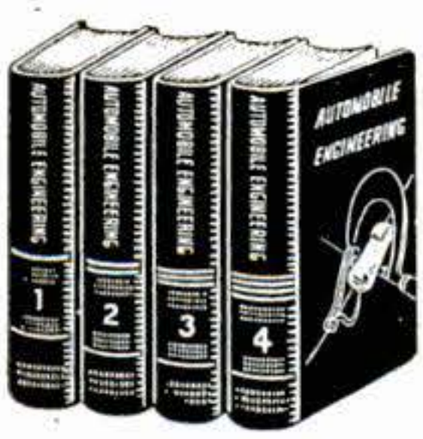

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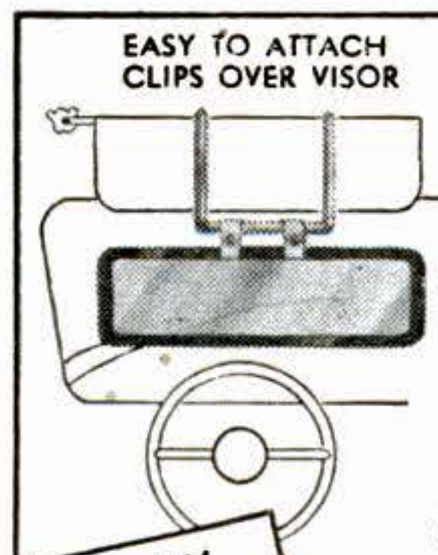

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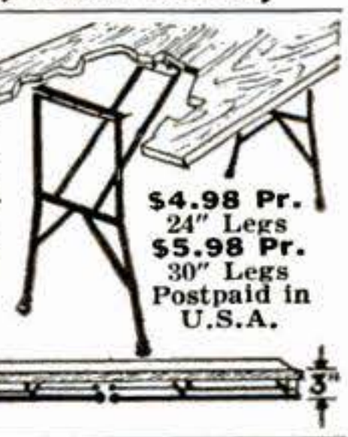

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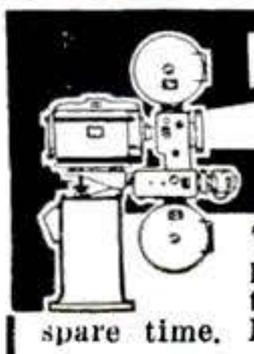

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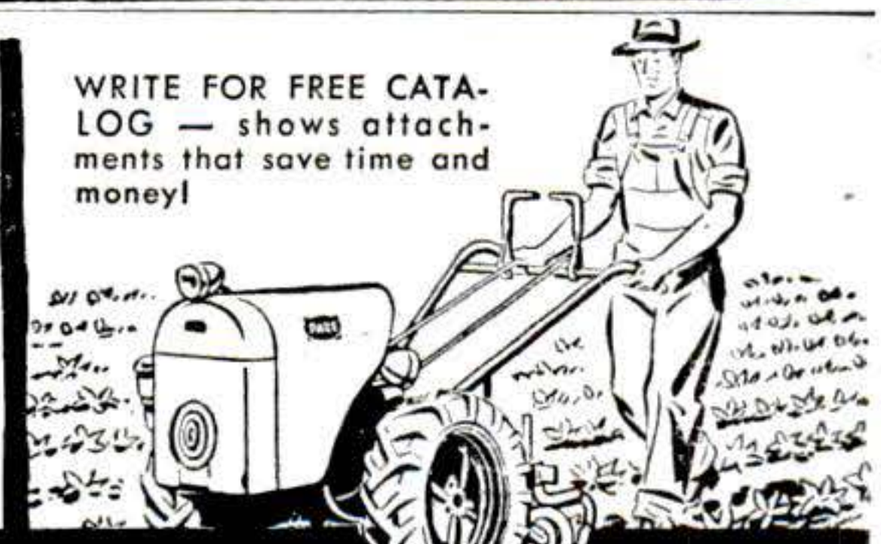

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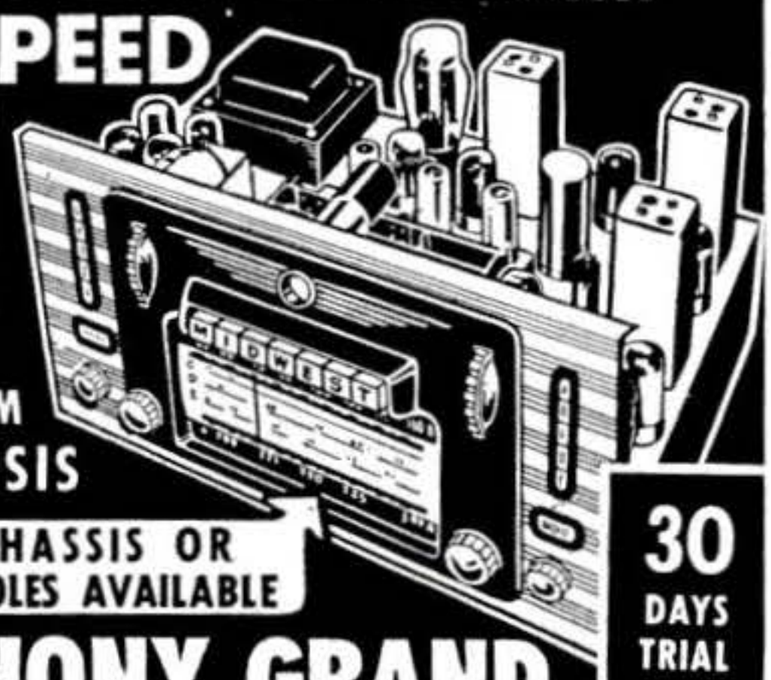

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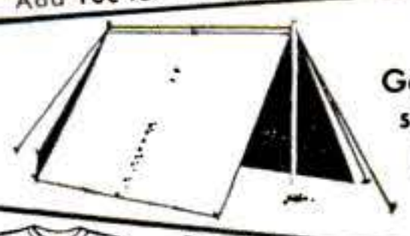

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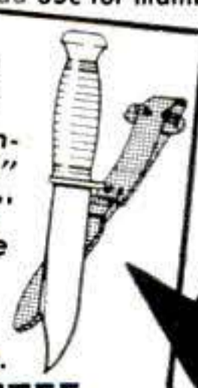

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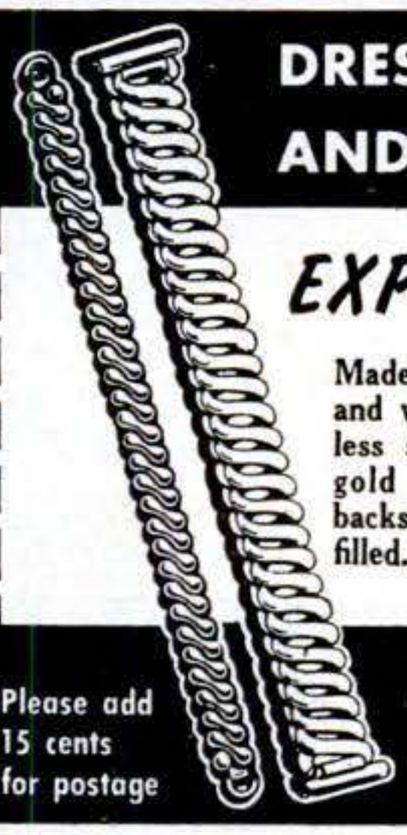

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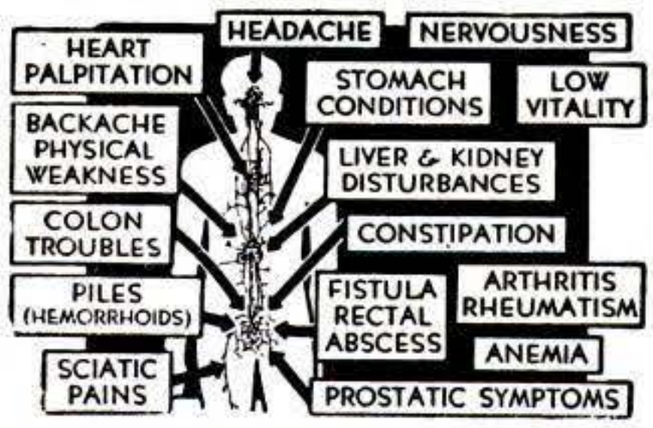

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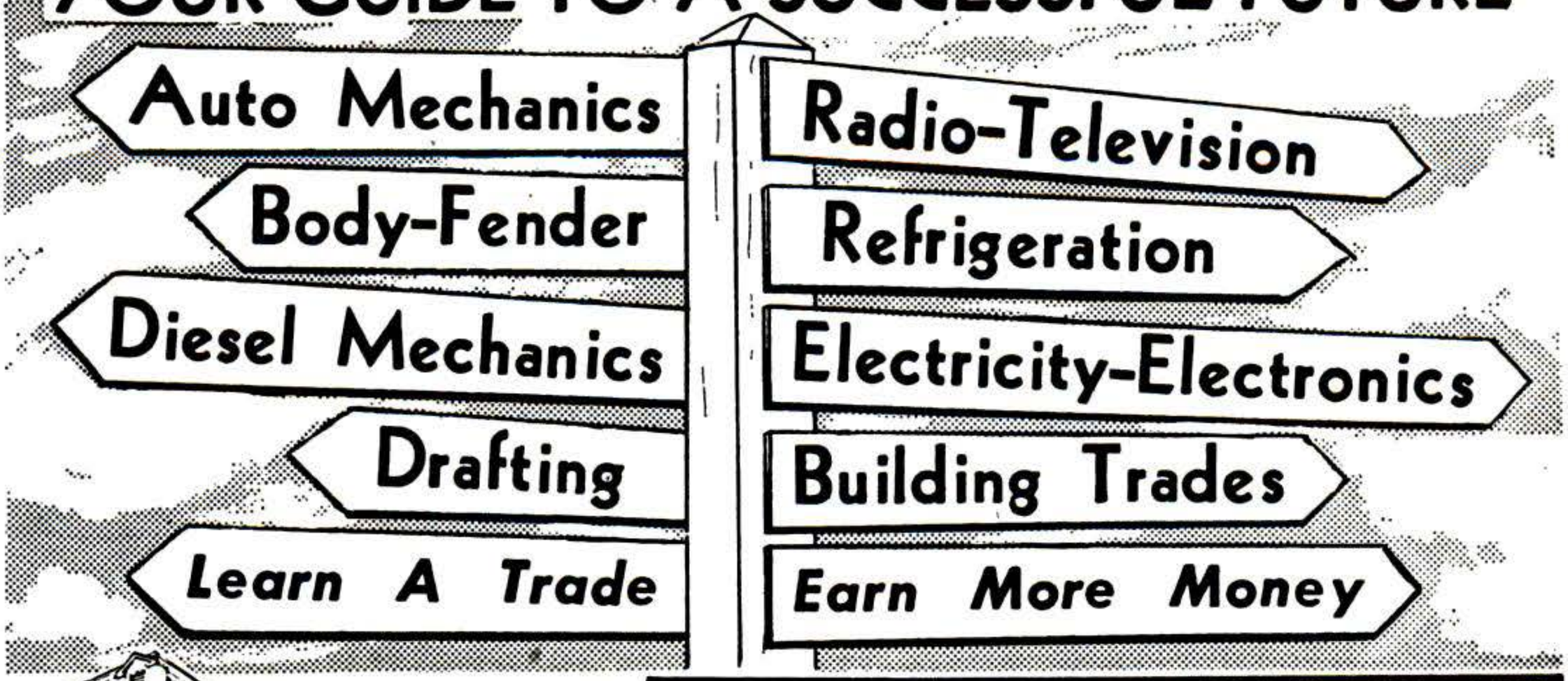

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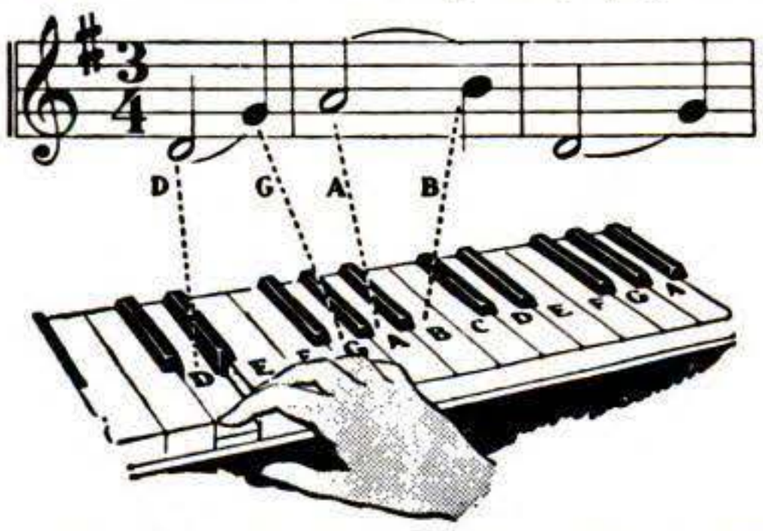

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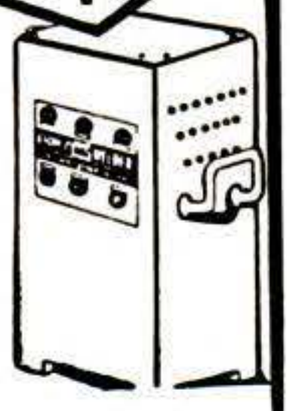

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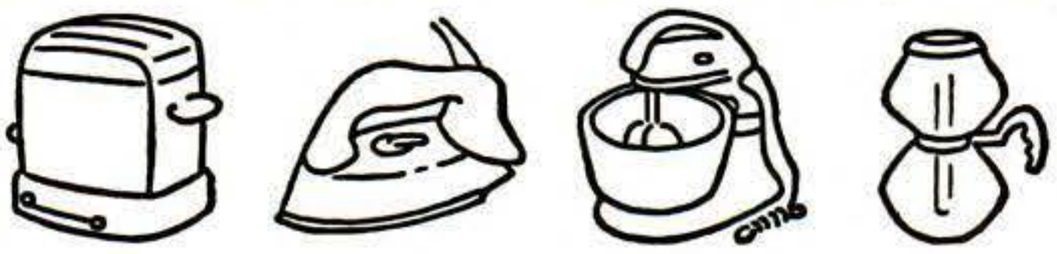

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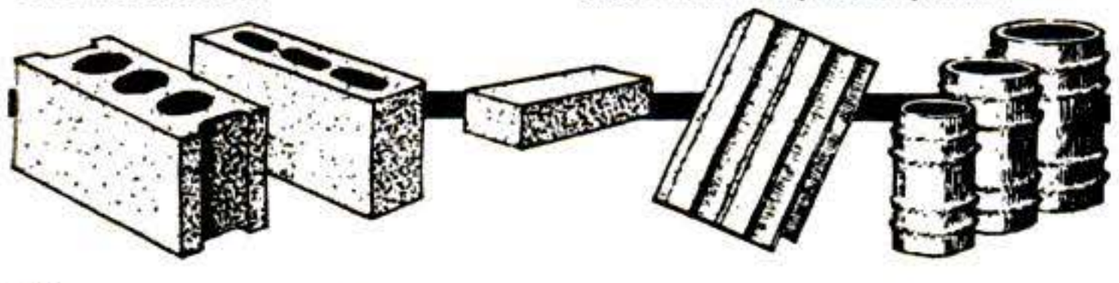

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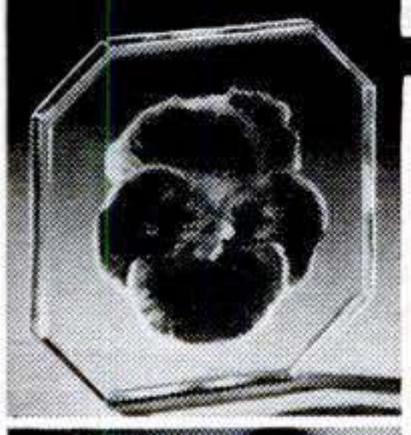

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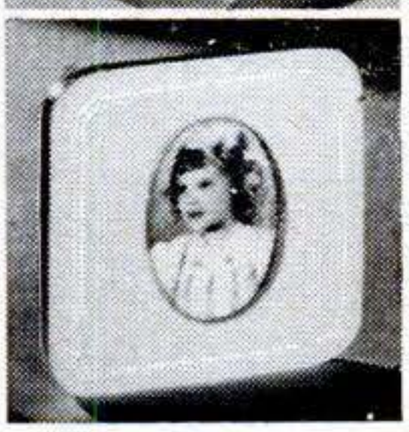

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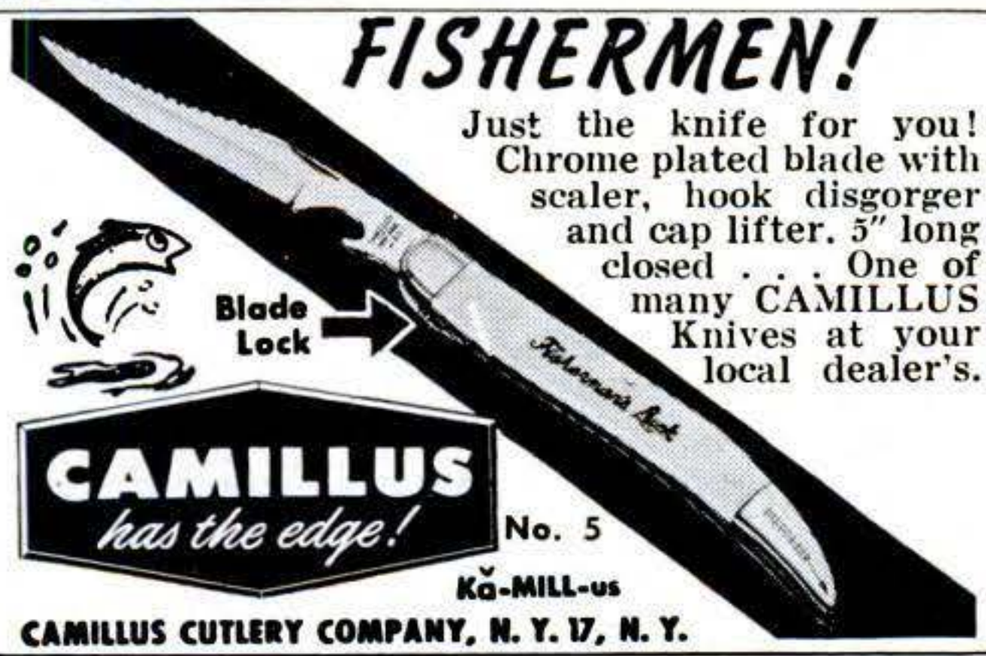

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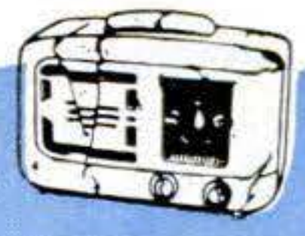

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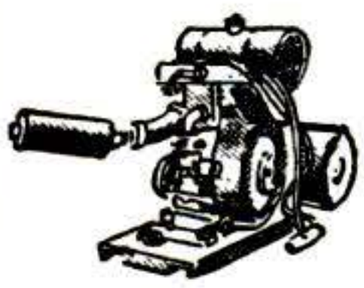

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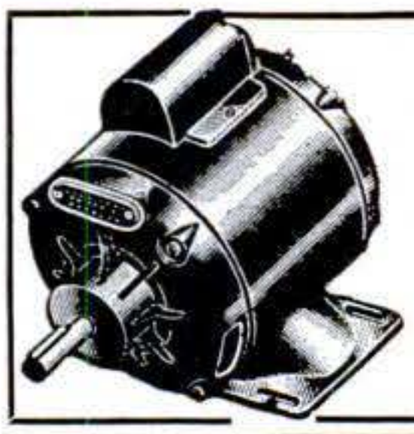

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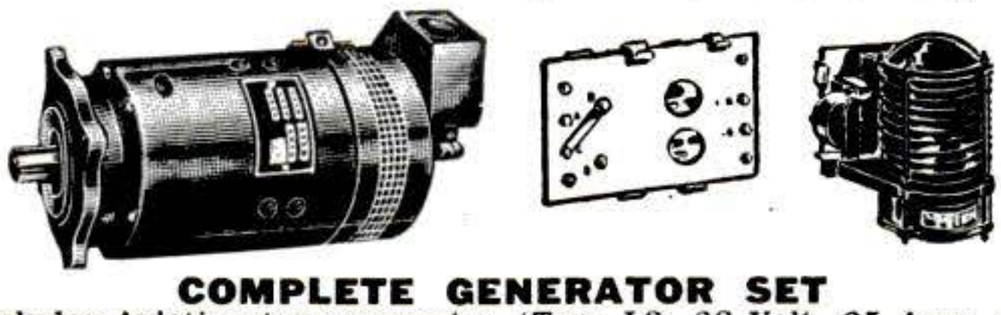

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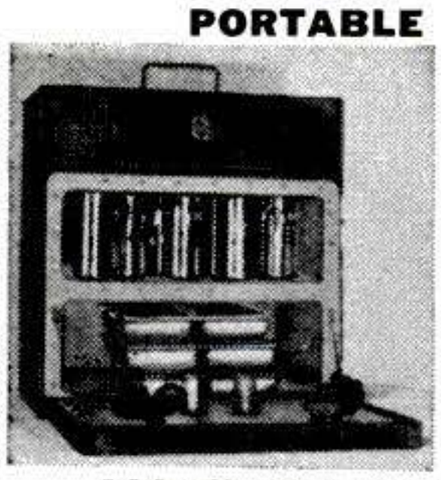

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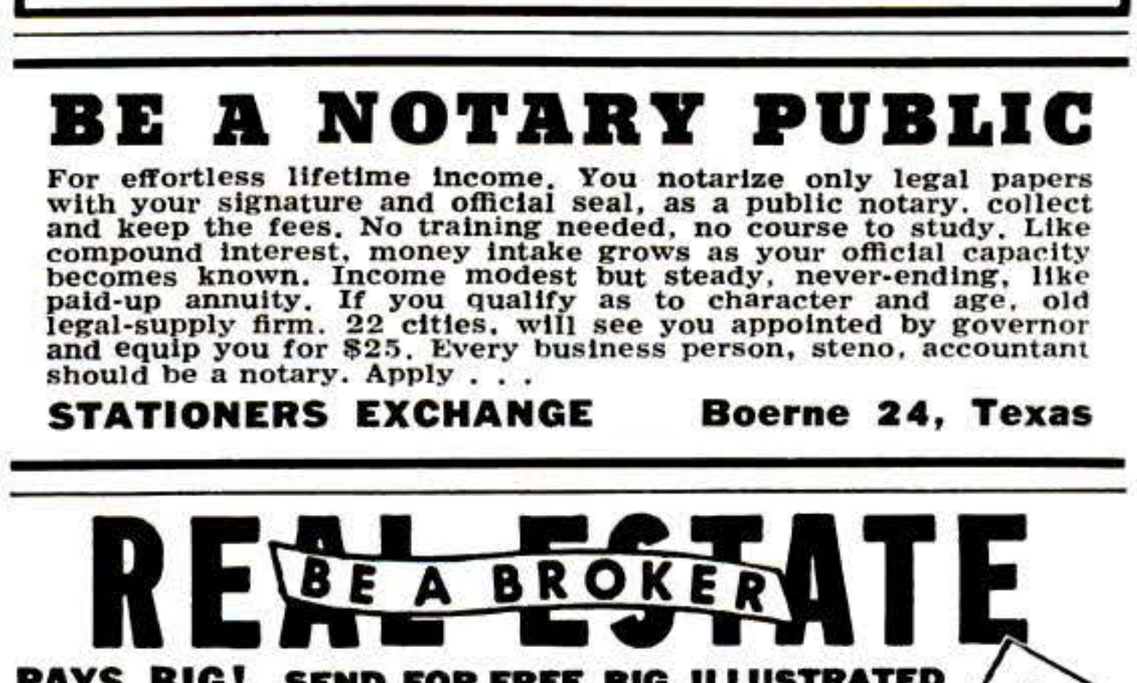

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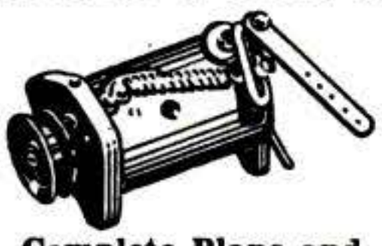

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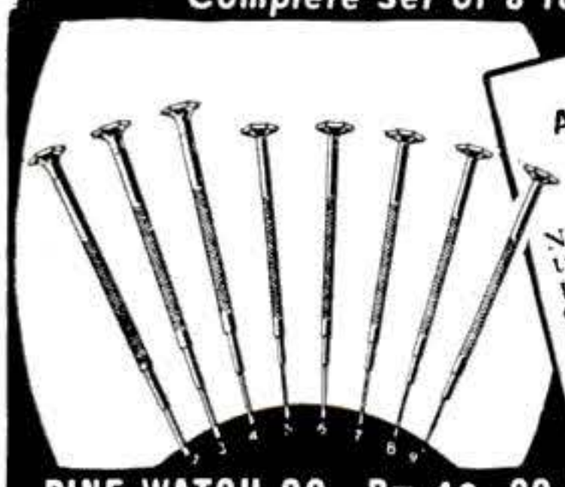

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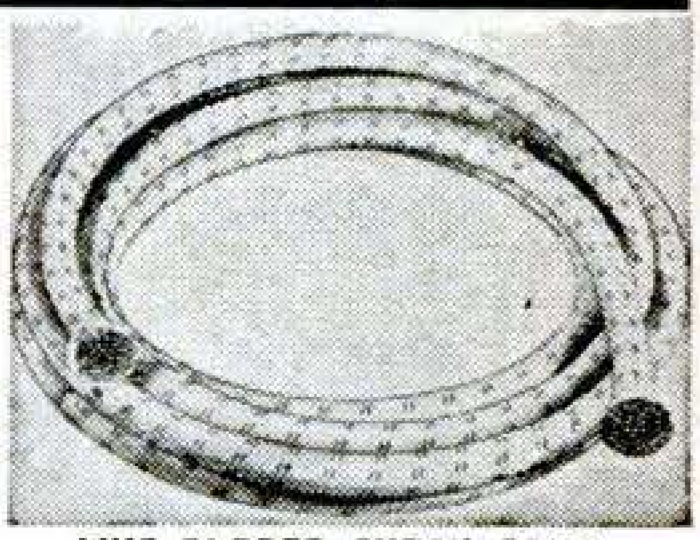

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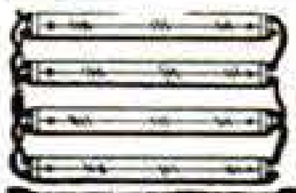

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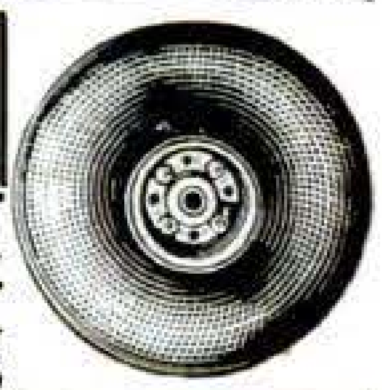

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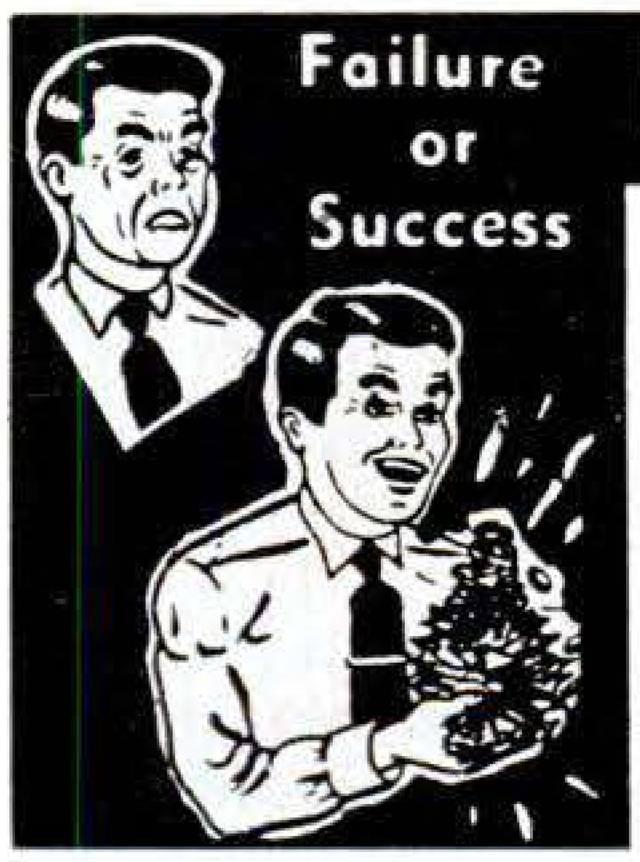

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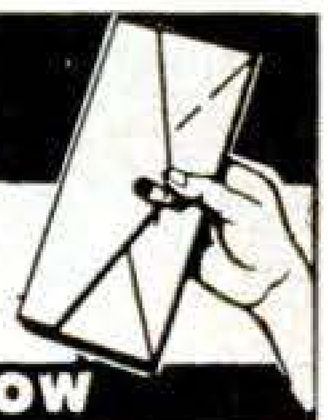

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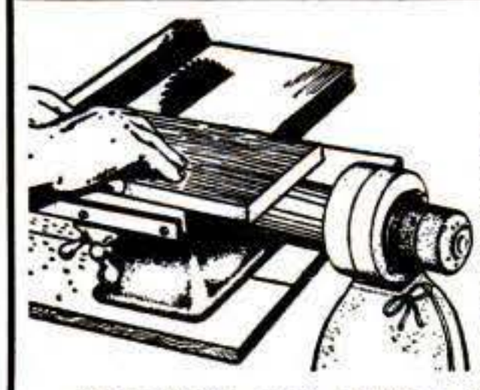

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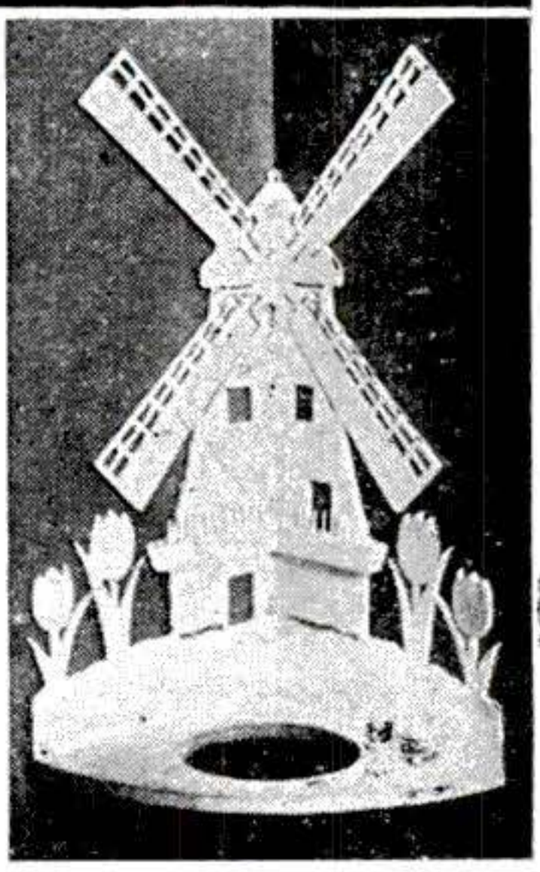

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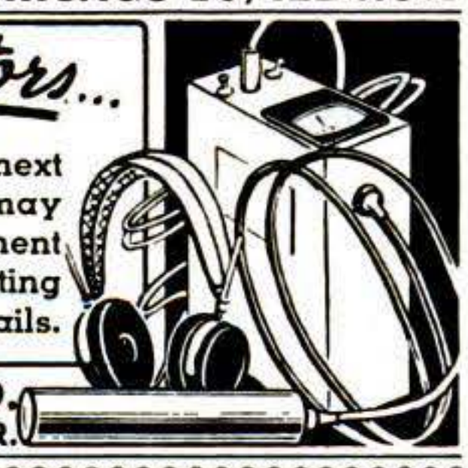

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Of course. Kermath is continuing to produce its conventional line of engines. the largest range in the business: 5 to 550 H. P. in gasoline—1 to 12 cylinders; 27 and 200 H. P. in Diesel—2. 4 and 6 cylinders. In marine engines the boating enthusiasts can't have a requirement that Kermath can't fill.

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Genuine Vickers constant displacement high pressure pump. Use it for any type of liquid pumping job. Will pump 400 gal. per hour at 3750 R.P.M. Precision piston type design provides 1000 lbs. per square inch pressure. Self priming. Standard thread ¾ inch intake and discharge ports. With ⅝ inch splined shaft—just add pulley and power and you're ready to go.

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These pumps are brand new. Original acquisition cost approx. $100.00. Can also be used as hydraulic motor; for rams, opening doors, hydraulic lifts, etc. also for any liquid transporting job. War surplus, but brand new. Shp. wgt. 7 lbs. Will include at no extra charge an hydraulic control valve and ship postpaid when remittance accompanies order. (Control valve, only $1.95.) Satisfaction guaranteed. Rush your order today. **$9.95**

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15,000 BTU. fuel vapor type heater utilizing air ram for greatest efficiency. Size 23" x 7" x 3". Complete with stainless steel heat exchanger, fuel filter, solenoid valve metering device, 24V firing unit, relief valve, diaphragm switch, etc. Instruction booklet furnished. Shipped in original factory box, total weight 30 lbs. Now selling at only..... **$12.95**

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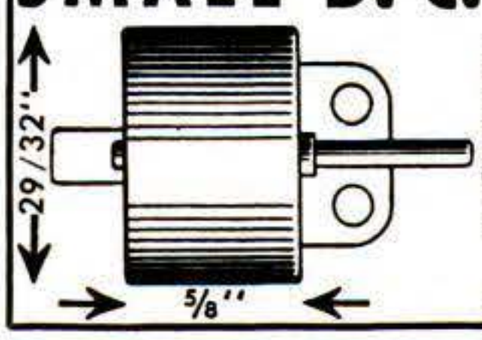

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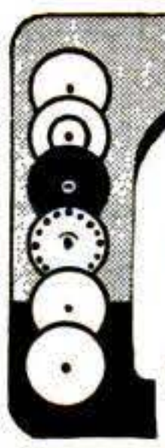

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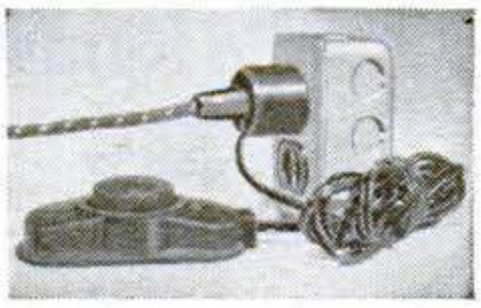

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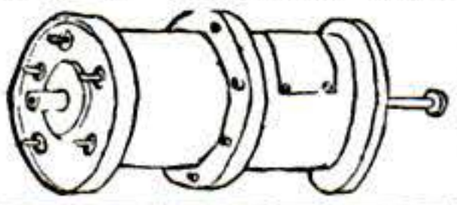

2 ALUMINUM GEAR BOX 18x8x7 that contains two powerful electric motors and two matched gear trains, 62 gears in all varying in size from ½ to 4 inches in diameter. This unit is readily converted to rotate a beam antenna or any other similar use **$5.00**

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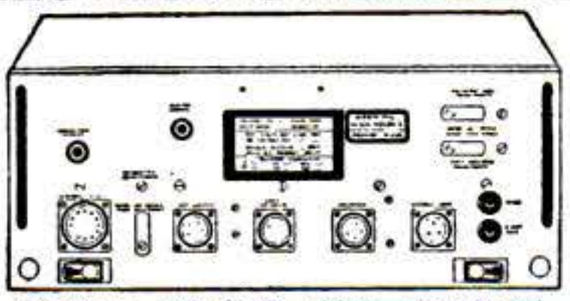
ELECTRONIC ALTIMETER



This famous 18x9x7 CAA approved unit, which weighs only 25 lbs. without plugs or cables, light enough for the smallest plane, cost the gov't $2000, and includes a transmitter, a receiver, all tubes, altitude indicator, altitude limit switch, and two easily installed 11" antennas. Working on the radar principle the receiver measures the absolute altitude from 3 to 4000 feet with precision enough for blind landings. In addition the altitude limit switch gives an alarm if the plane's height varies more than 10 feet from any preadjusted value. This unit might also be used to warn boats of any obstacle that is on their course. 12V, $75.00, 28 volt model **$45.00.**

General Electric 15-Tube Transmitter and Receiver Set

This brand new 15 tube transmitter-receiver was designed for mobile service on 12 volts, and will operate in the "Citizen's Band," where no amateur license to transmit is necessary. It's a cinch for any experimenter to connect this unit for 110 VAC operation by following the instructions and diagrams supplied, which cover numerous applications, including television. For those intending to use on car or boat, a new dynamotor, exactly as originally supplied, costs only $15.00. Don't fail to write for FREE descriptive bulletin. Order our RT-1248 for only **$29.95**, or two for **$53.90.**

Signal Corp Interconnector Relay Box 730A

This valuable unit, made by Bell, and more familiarly known by the U. S. Army designation BC616, is encased in a highly polished aluminum case 6½x5½x2½, and contains 150 mfd. of condenser capacity, sensitive relays, resistors, and terminal strips. Order several at the giveaway price of only . . **$1.95**

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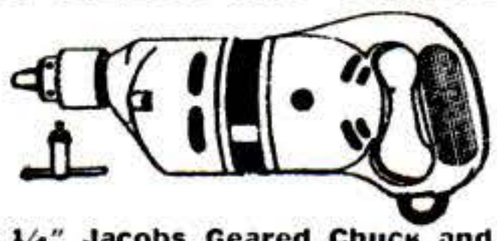

Equipped with ¼" Jacobs Geared Chuck and Key. Not an intermittent duty drill, but a full size rugged tool. Most convenient type switch, natural grip handle, and balance like a six-shooter. Precision cut gears– turbine type cooling blower—extra long brushes No stalling under heaviest pressure because of powerful 110 Volt AC or DC motor and multiple ballbearing thrust. Other bearings self-aligning lifetime-lubricated Oilite type. Made for toughest year-in and year-out service in plant or on construction jobs. Amazing perpetual factory guarantee assures you of a lifetime of trouble-free use. **Full refund (you pay transportation) if not pleased with drill after trial.**

BRAND NEW
TYPE LS-7 PM SPEAKER

In a fully-enclosed finished metal cabinet. This speaker and case match communication receivers, and in addition make perfect intercom remote stations. Our price **$4.50.** Including output transformer **$4.95**

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Complete with 9 tubes including picture tube. This Plan-position-Indicator Oscilloscope has a self-contained pack designed to run from the 115 V. power supply on LST or PT boats. It provides a 5" diameter picture adjustable at will to an 80, 40, 4 or 2 mile circle with the boat at the center, showing location of land, other ships or any obstruction, so that navigation can be carried out in pitch darkness or pea-soup fog with as much safety as in brightest sunlight. Your cost **$39.95**

SUPER SPECIAL Fairchild Bombsight Power Units

Each unit is brand new, contains 9 tubes which alone have a total value of $15.00; 8 electric motors or generators, 6 of which are of the permanent magnet field type; and 20 valuable precision resistors plus a multitude of the ordinary kind, in addition to many condensers and potentiometers. ALL for only **$14.95.** We will ship but one to a customer while our small quantity lasts.

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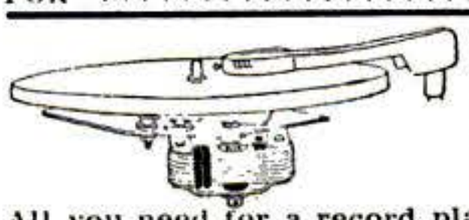
Each unit contains two 4 Mfd oil filled condensers and a high inductance 50 Amp. choke in fully shielded case. Suitable heavy current connectors are provided to plug into the input and output connectors at each end of the filter from your input and output wires. A filter with innumerable uses on oil burners, refrigerators, boats, automobiles and wherever noise is to be suppressed or interference abolished. A $17.00 VALUE FOR **$1.98**



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All you need for a record playing attachment for your radio except the cabinet. Special offer on phonograph arm and 115 V., 60 cycle motor, both top quality. **$7.95**

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1 BANDSWITCHING TUNING TURRET made by Western Electric. Covers 4 bands above 100 MC. ALL coils wound with #14 silver plated wire. Complete with tuning condensers and powerful electric driving motor. Diagram included. ONE OF OUR MOST TERRIFIC VALUES—ONLY **$2.95**

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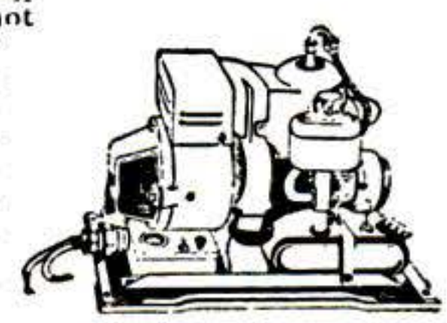
3 AUDIO AMPLIFIER — Brand new, dual triode amplifier having 2 of the valuable and scarce ouncer type audio transformers that sell for over $10.00 apiece. Neat aluminum case, fully enclosed (largest dimension 6 inches). Perfect for intercom systems, phono amplifiers, mike amplifiers, or signal tracer amplifier for testing radio sets. A sensational bargain at only. . . . . **$3.40** each.

Our PE-109 *DIRECT CURRENT* Power Plant

This power plant consists of a gasoline engine that is coupled to a 2000 watt 32 volt DC generator. This unit is ideal for use in locations that are not serviced by commercial power or to run any of the surplus items that require 24-32v-DC for operation. The price of this power plant tested and in good condition is only **$79.95** F.O.B. Buffalo, or we can supply in strictly "as is" condition for **$58.95** F.O.B. New York City. These latter are exactly as received, in heavy steel-strapped gov't cases, and we are unable to determine if the individual units are new, or what the condition is if used, while the **$79.95** are some of the same that we have brought to Buffalo for testing and repair if necessary. We do not recommend gambling on the "as is" condition, except for quantity purchasers. We can also supply a converter that will supply 110v AC from the above unit or from any 32v DC source for **$12.95.**



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Milliamperes AC—0 to 50
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Total Price, prepaid anywhere in the USA—$7.00. Similar DC Meter, lacking the AC operated ranges of above, **$5.50** prepaid.

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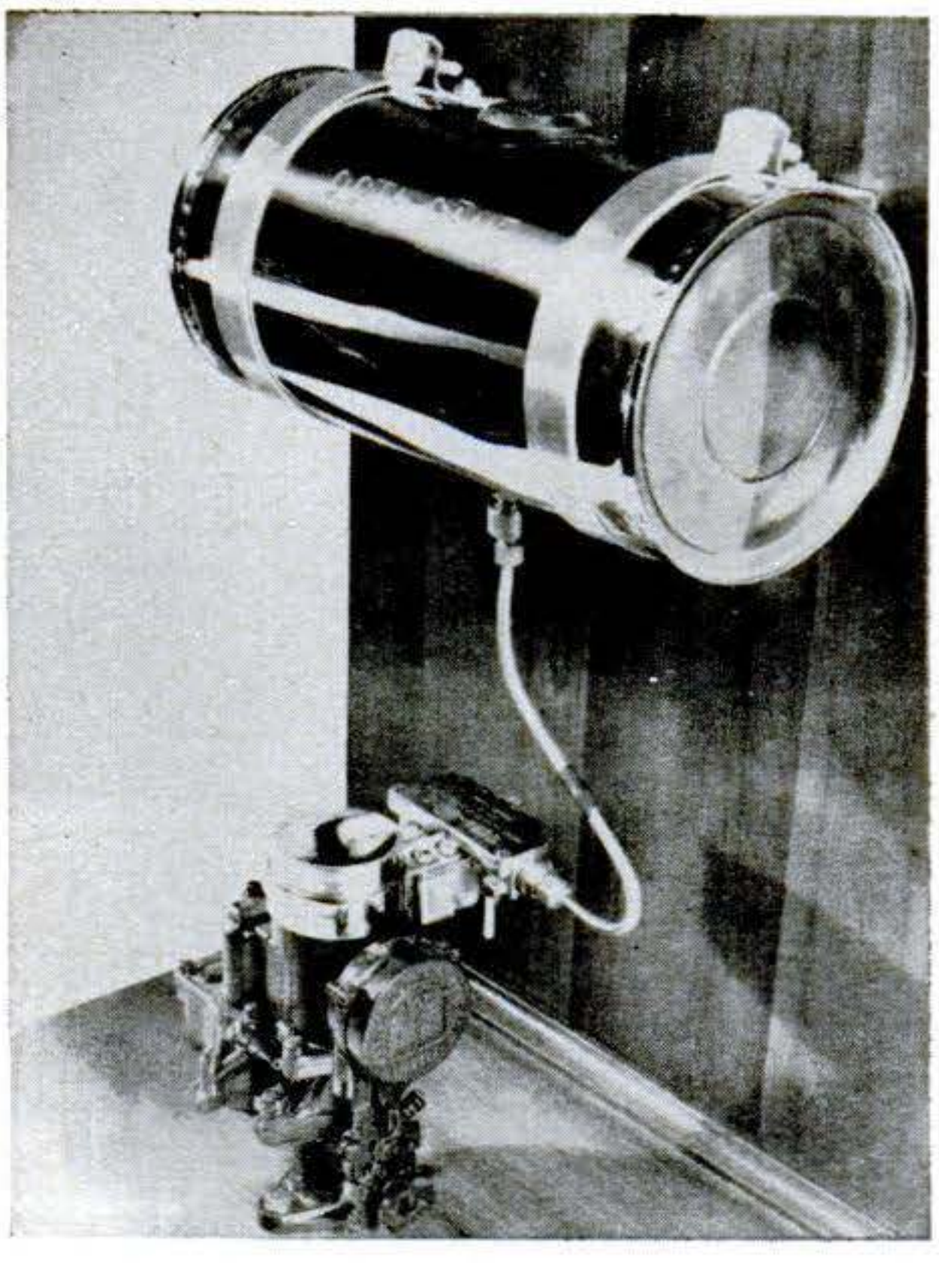

The Octagane Water Injector is designed to give you premium performance — and better — from regular gasoline. It will eliminate "ping" or "knock," and your engine will last longer because it is kept absolutely clean. You will have the use of all your engine's horsepower. The Octagane is designed to last for the life of your car. It is constructed to rigid engineering specifications of finest quality bronze, copper, and stainless steel. It comes ready for its simple installation down to the last nut and bolt. And, of course, a one year guarantee comes with it. Send for the Octagane today and give your car a new lease on life!

We believe that you, as a reader of Popular Science, are a leader in taking up new developments in science and technology, such as the Octagane Water Injector. We also believe that your friends listen to your advice on technological developments. Therefore, we make the following offer, which we believe has never before been made by anyone in any national advertisement:

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2. We will send you absolutely free a Gane Airflow Idling Needle Kit for your car. (These needles will give you 1 to 4 added miles per gallon. The Gane and the Octagane work together—the Gane improves performance and mileage below 20 m.p.h. and the Octagane does the job above that speed.) The regular price of the Gane Airflow Needle is $3.00 per pair.

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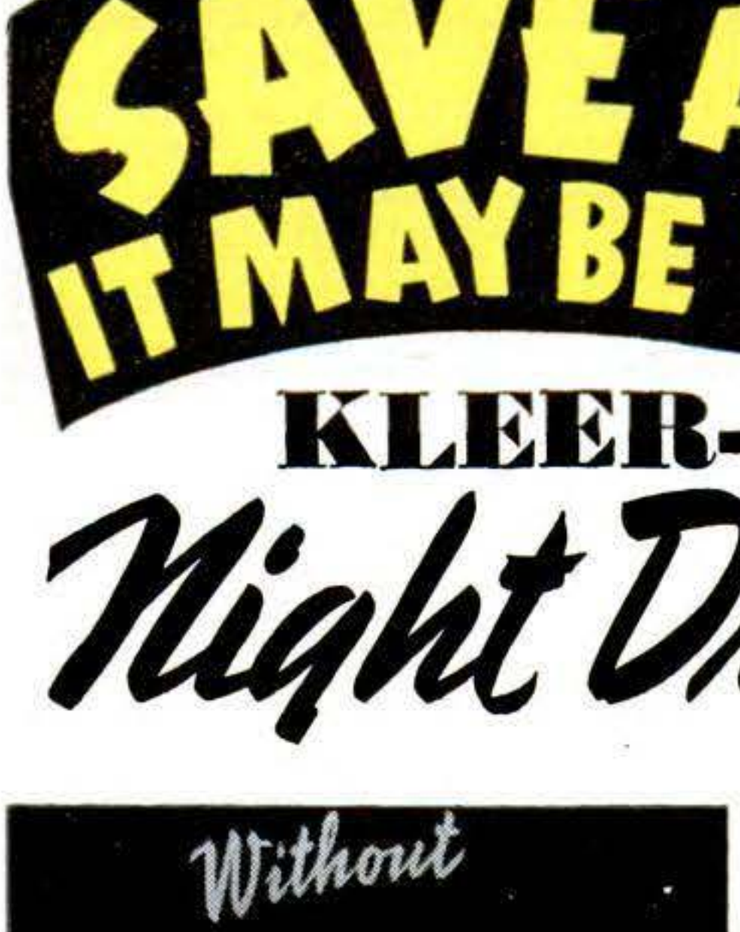

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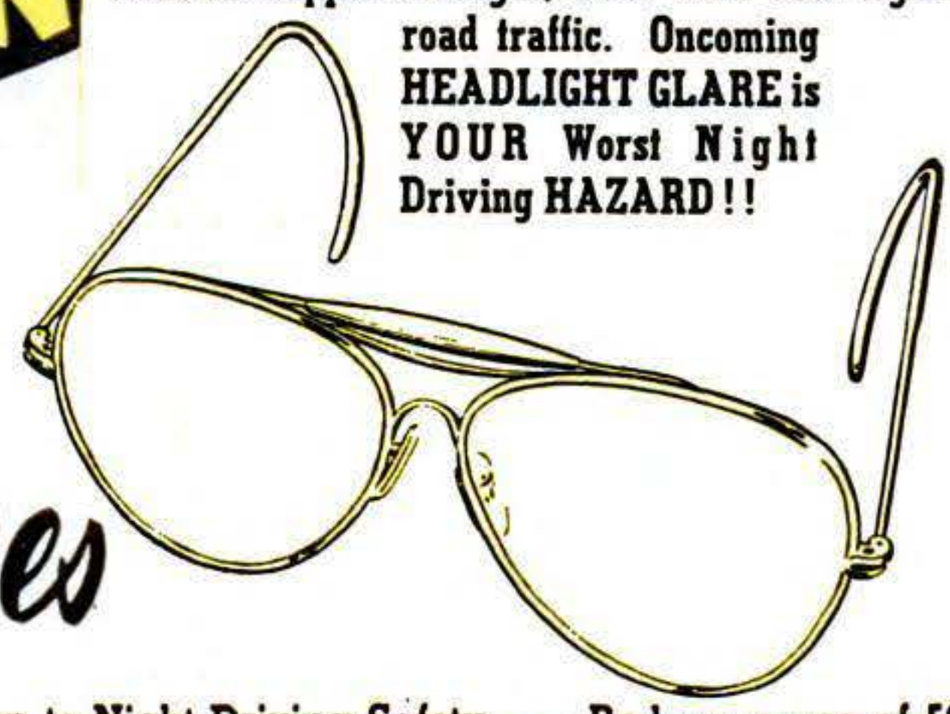

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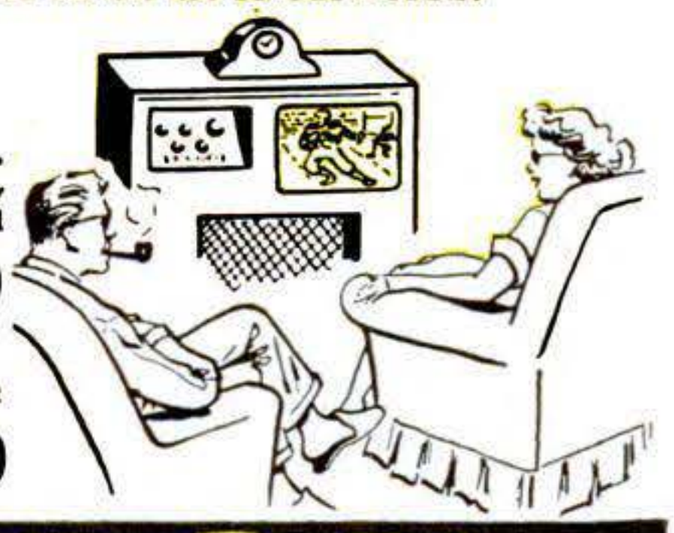

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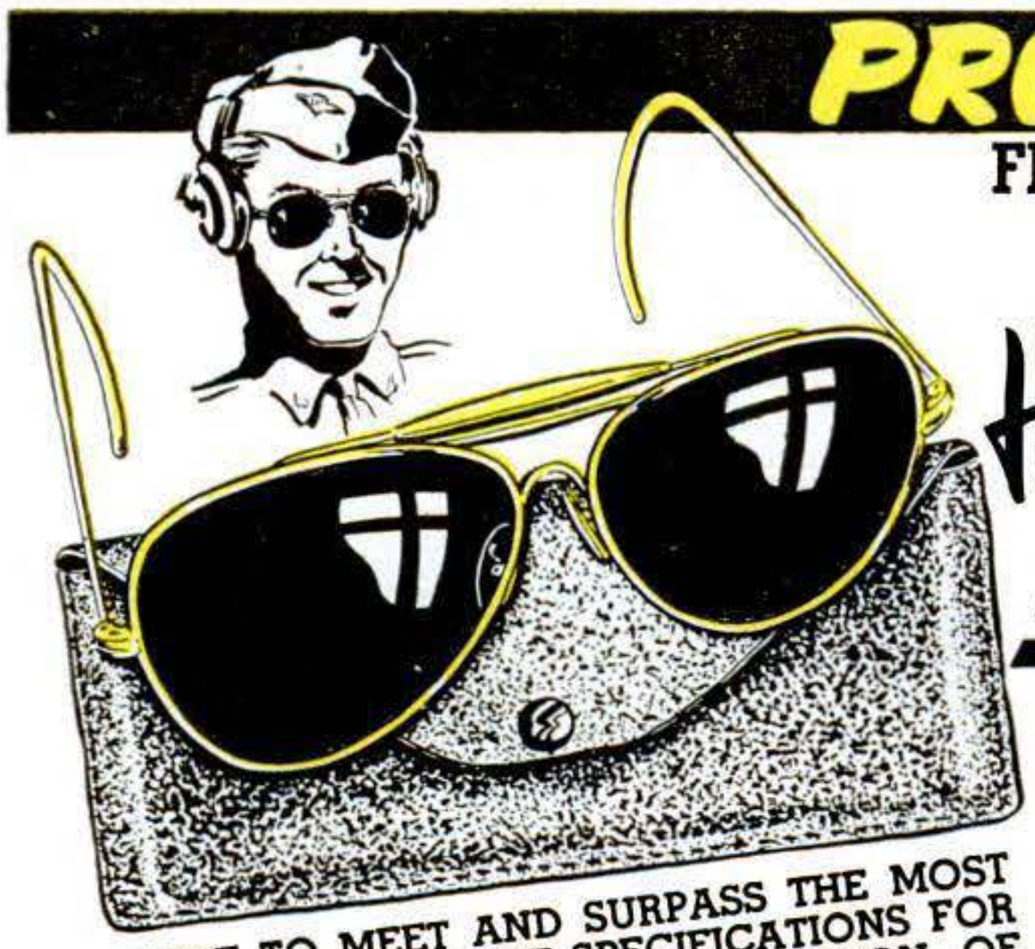

MADE TO MEET AND SURPASS THE MOST RIGID GOVERNMENT SPECIFICATIONS FOR THE ELIMINATION AND ABSORPTION OF ULTRA VIOLET AND INFRA-RED RAYS.

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GENUINE U.S. ARMY AIR FORCE
SUN GLASSES
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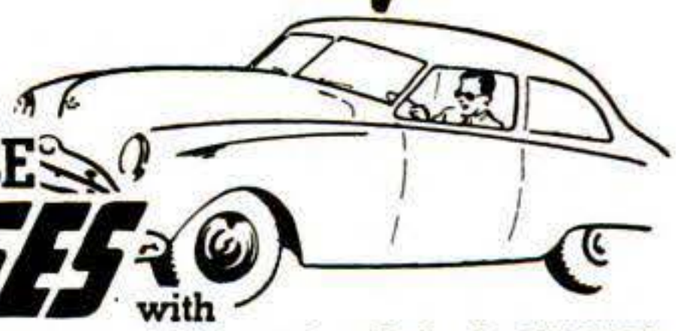

6 BASE optically correct precision ground and polished, GLARE-FREE LENS. Adjustable gold plated frame, Pearloid Sweat band and pads. Beautiful leather case that can be attached to belt.

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Effectively protect your eyes from harsh glare of summer sun & winter snow. Wear these smartly-made, official Army sun glasses for care free, glare-free pleasure . . . the year 'round!

ARMY AIR FORCE TYPE SUNGLASSES
In appearance like above but with 4 base lens In leatherette case. Both men and womens sizes **SG-2 A $5.50 Value $1.95**

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NEW

All Wool, Sturdy, Warm Zipper front 2 slash pockets, Taped Collar. Wonderful Buy For Utility and long lasting Qualities **$5.69**

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Mildew & Flame Resistant. Cheap Outside Storage. They are Really Moving at These Prices.

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Nothing else necessary. Don't fly blind in the air or on the ground.

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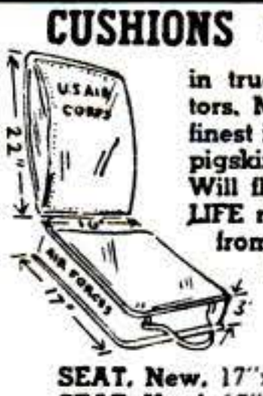

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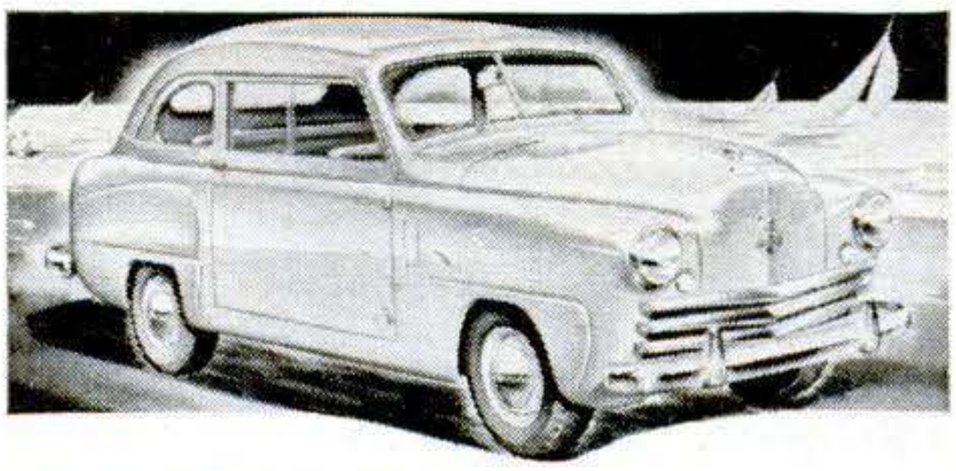

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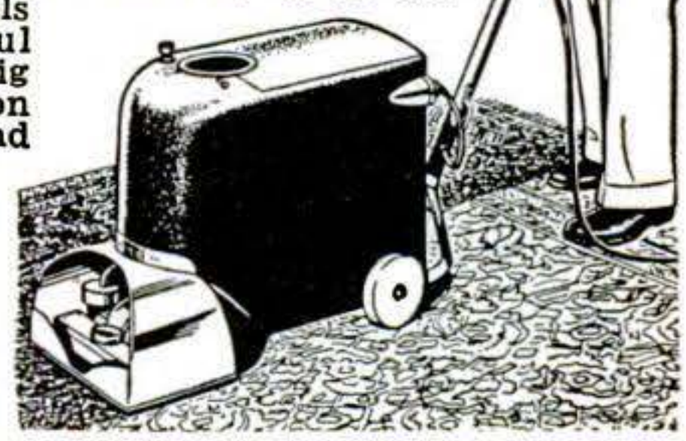

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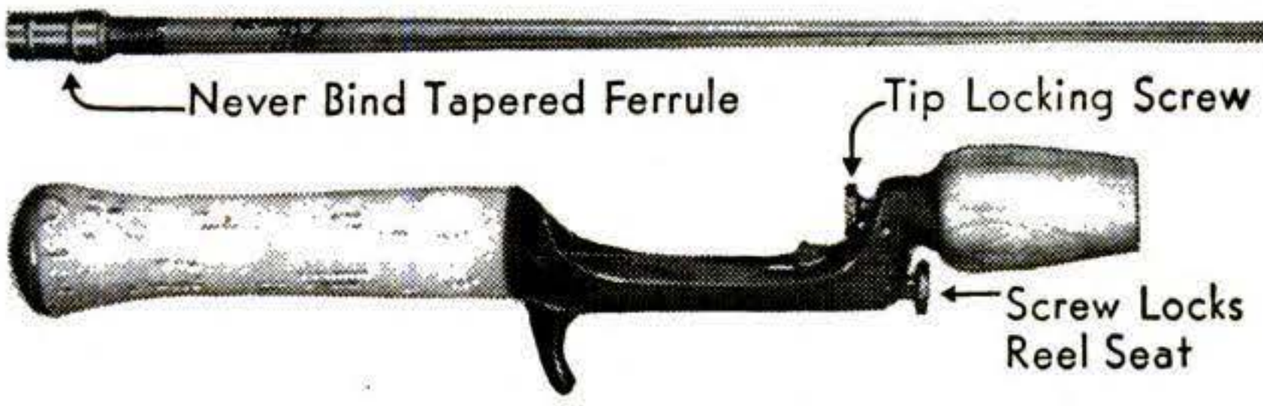

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Lengths—4½, 5, 5½ feet
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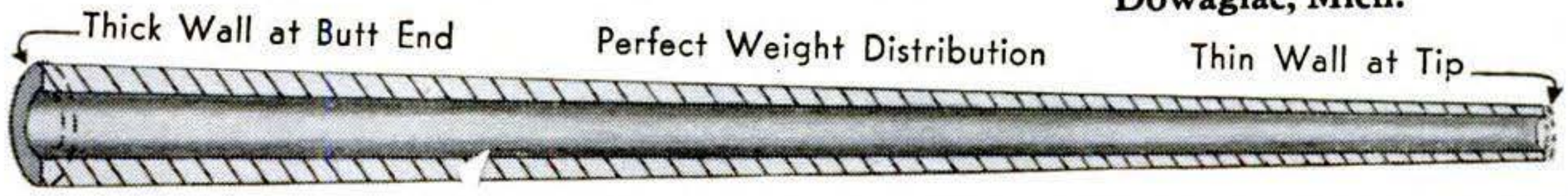

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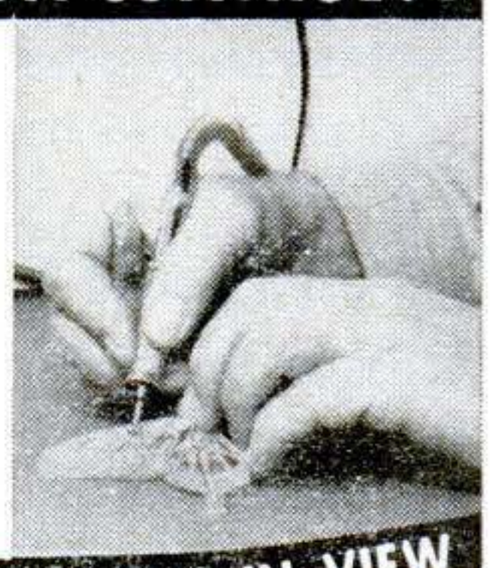

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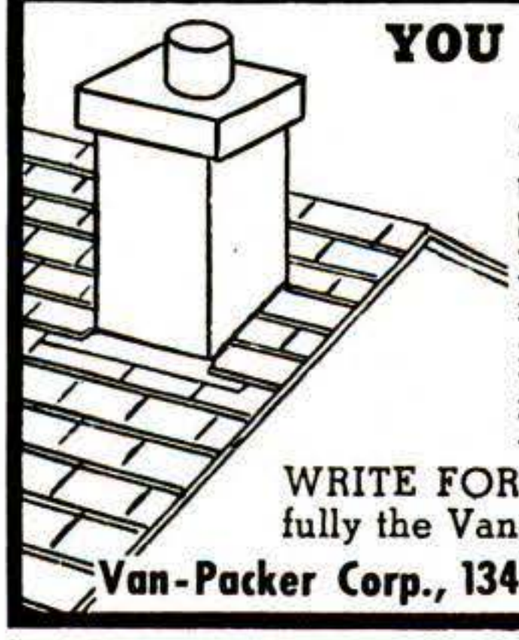

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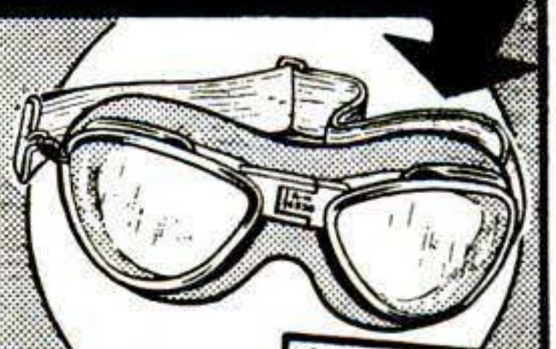

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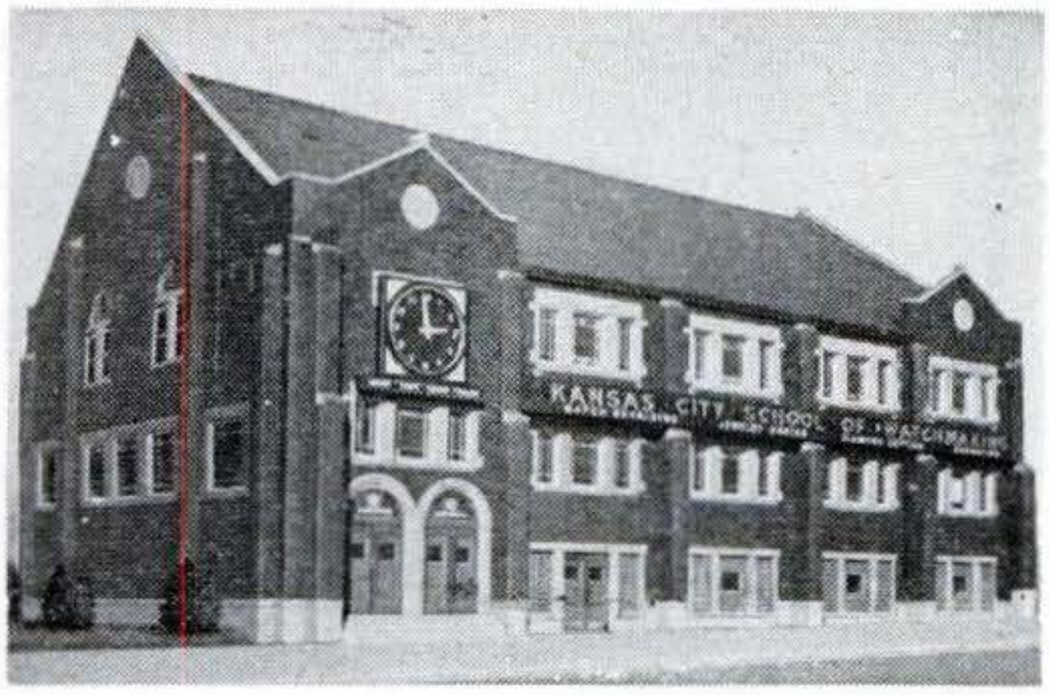

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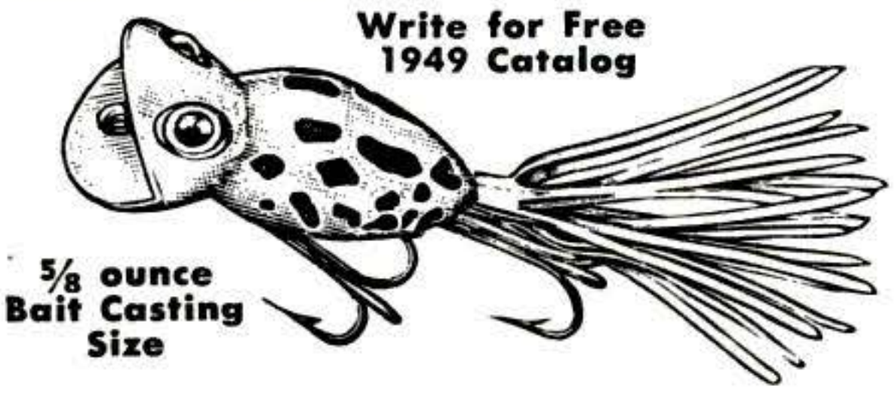

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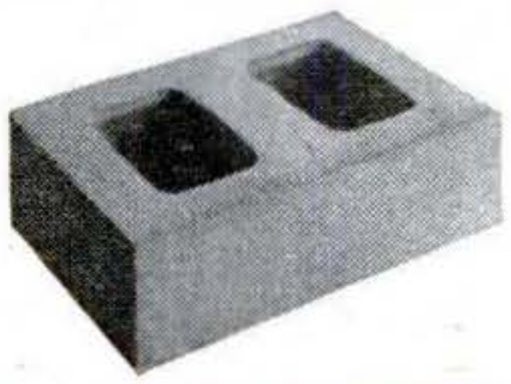

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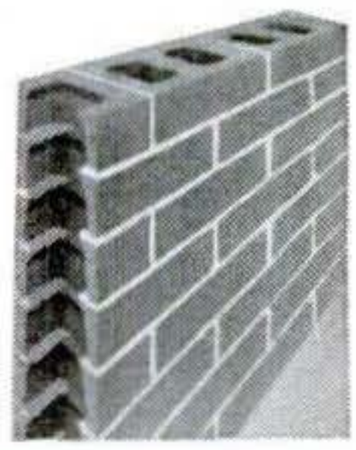

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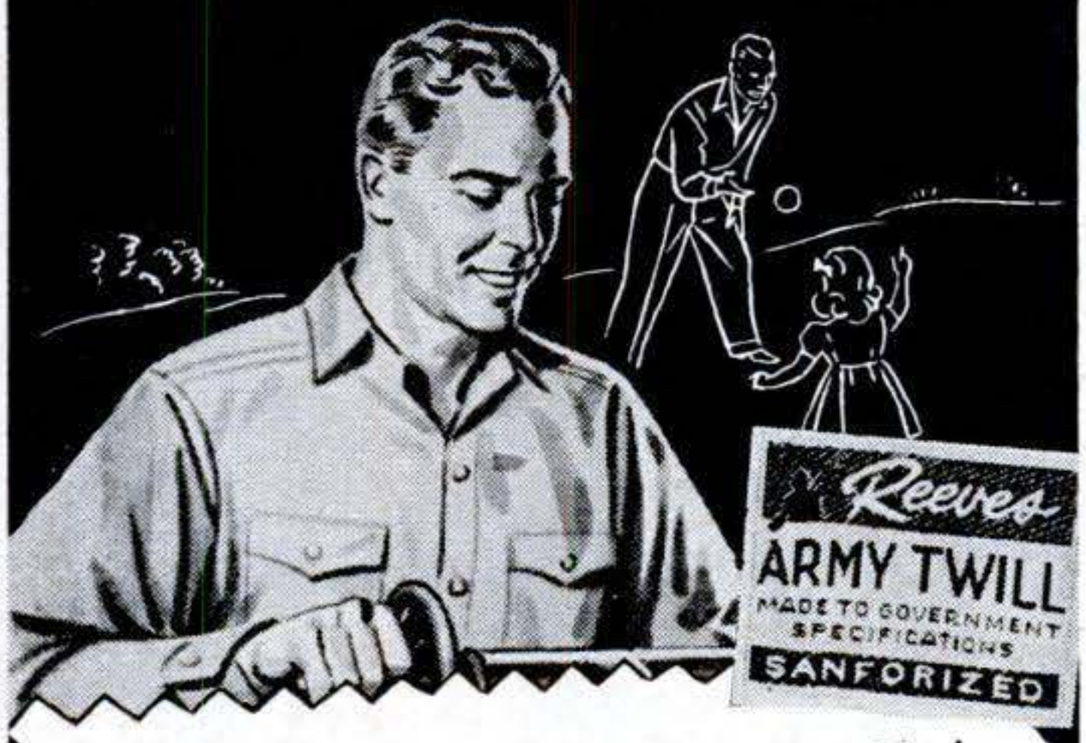

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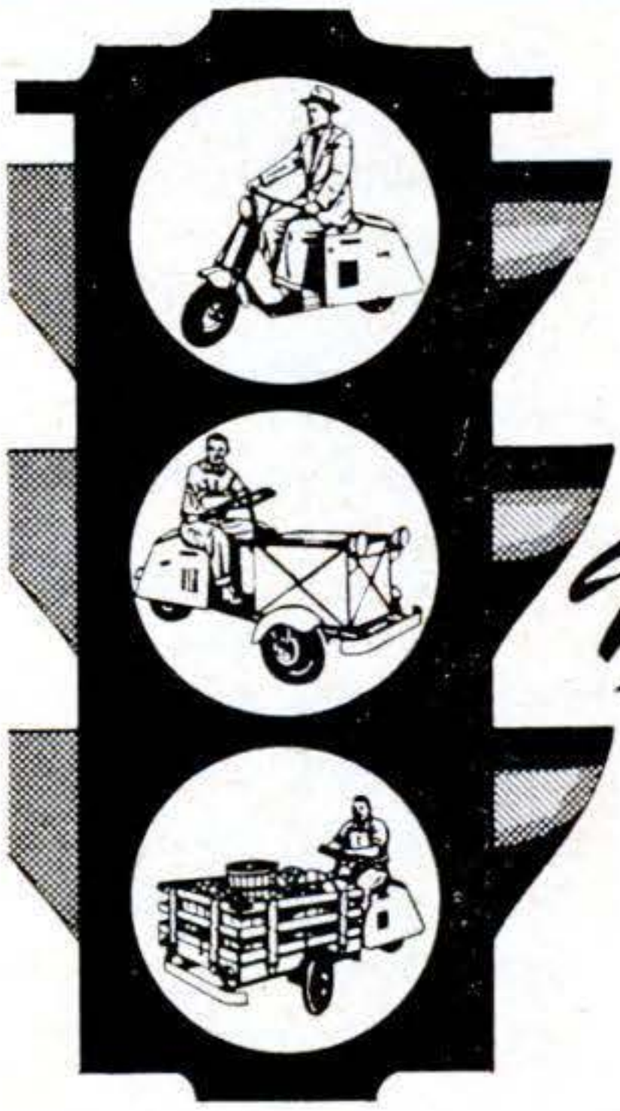

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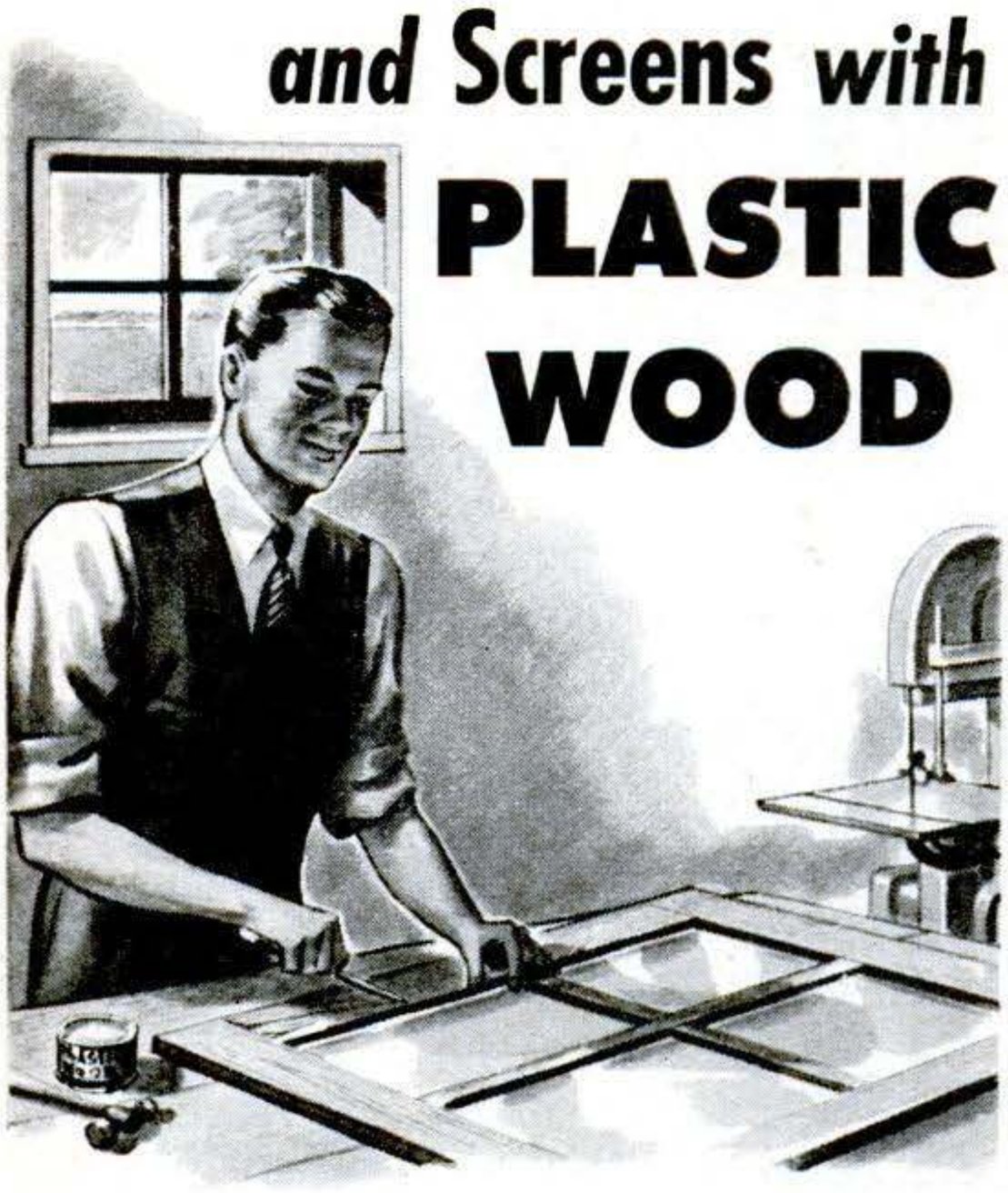

When making new screens, or replacing old rusted screen, apply thin layer of PLASTIC WOOD around frame after tacking down screen. This gives greater strength to the frame. PLASTIC WOOD can be easily shaped to match broken molding. Valuable in replacing rotted wood in storm windows.

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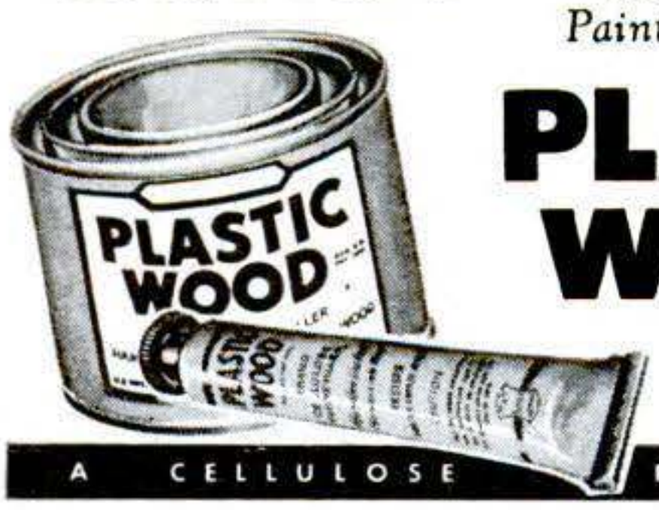

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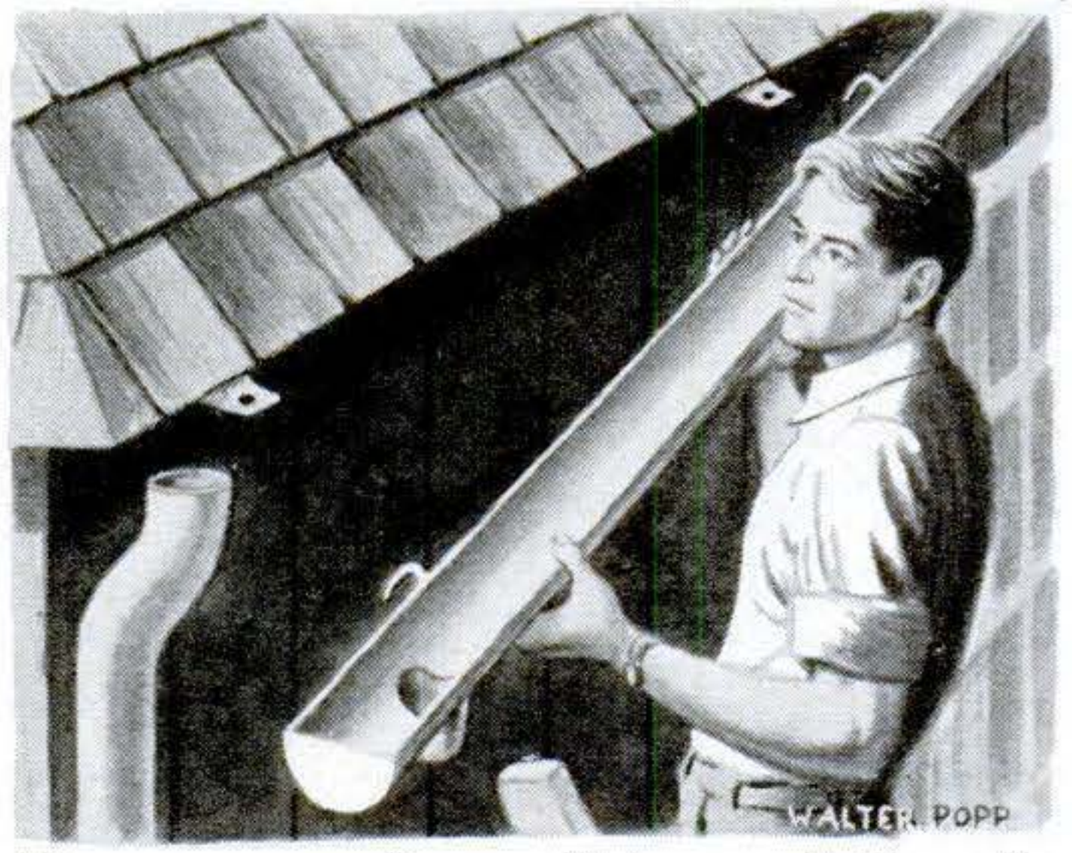
Standardized insect-spray equipment, with all can tops and spray-gun caps identical. Then a gun would fit any can. Feed tubes of flexible plastic would adapt themselves to any can depth.—*Willard Dalrymple, Bowling Green, Ky.*



Pin-up gutters for small homes, held up by hooks and easily removable. All painting, cleaning, and repairing could be done on the ground, a big help to the small home owner.—*Le Roy J. Ehrhard, Mary Ridge, Mo.*

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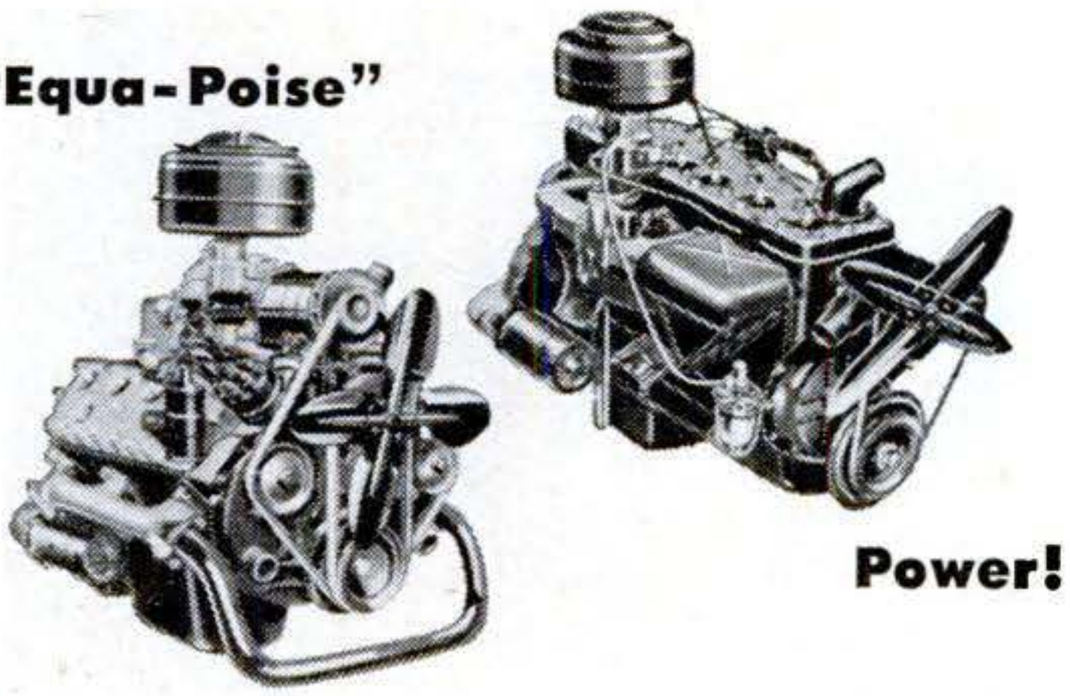
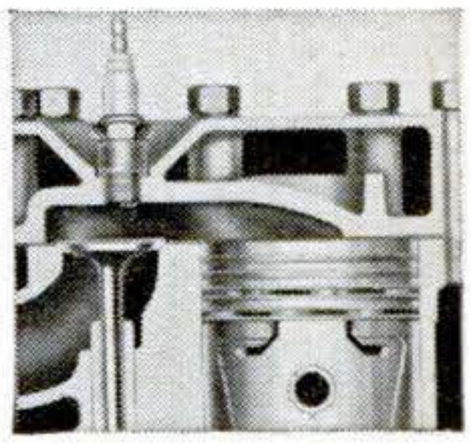


Take your choice of either the new 100 h.p. V-8 or the 95 h.p. Six and get smooth, brilliant performance. Both engines are "Equa-Poise" mounted. Both incorporate a number of advancements in basic design—both are truly *new*. New "Equa-Flo" Cooling System, "Deep-Breath" Manifolding, "Power-Dome" Combustion Chambers and improved lubrication all contribute to Ford's feeling of responsiveness.



Ford "Power-Dome" Combustion Chamber

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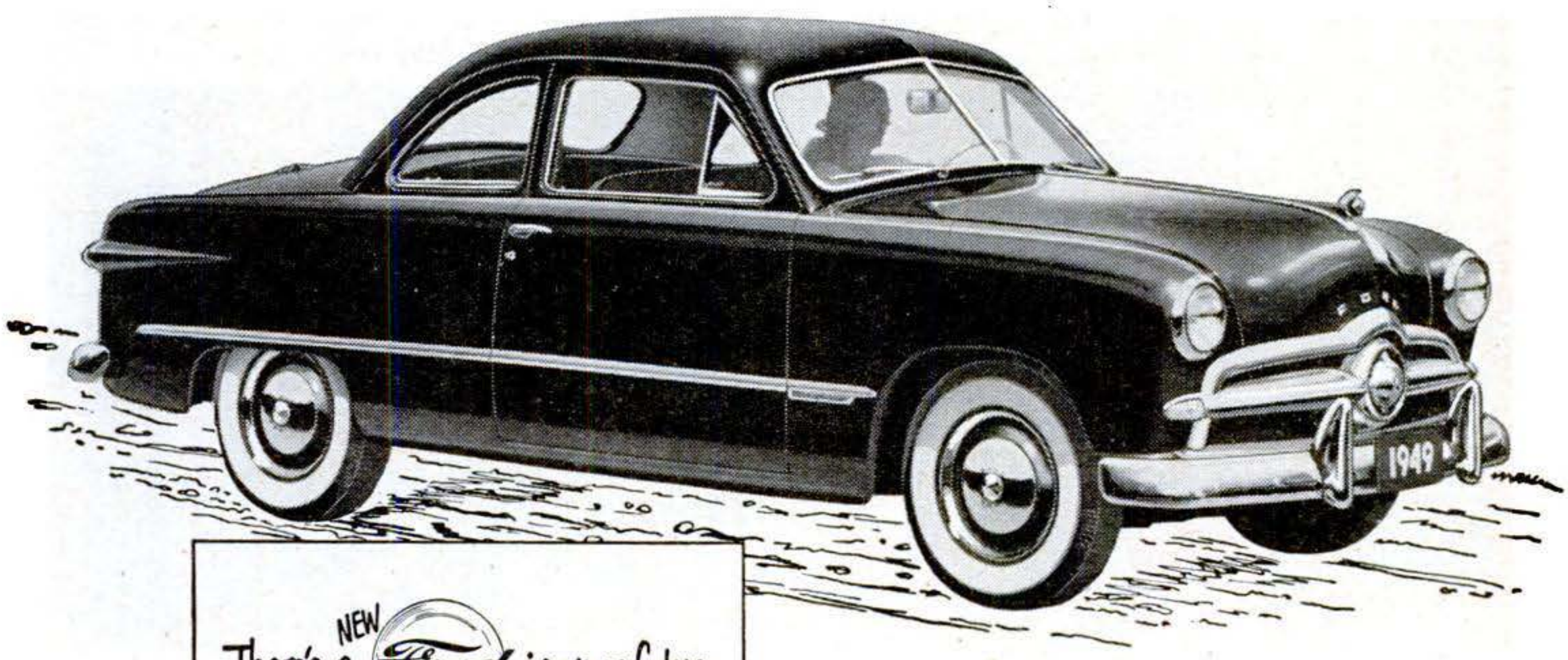

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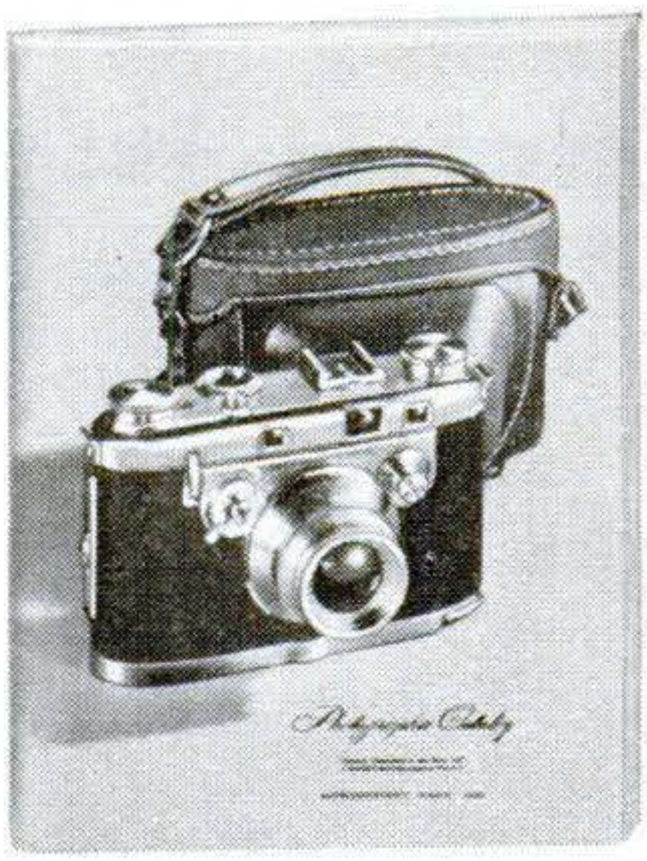

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OVER 1000 ILLUSTRATIONS—descriptions and prices of more than 1700 pieces of photographic equipment are included in Montgomery Ward's big, new Photographic Catalog.

THE NEWEST IN STILL CAMERAS — the sensational new Land camera that gives you a finished print just 60 seconds after you snap the shutter! The new Bell & Howell Foton automatic 35 mm. (takes up to six pictures a second); the new low-priced Bolsey miniature with twin lens reflex focusing; and many others.

THE LATEST IN MOVIE CAMERAS—the new Cine Kodak Special II (approaches the capacity of professional movie cameras), the new De Jur 8 mm. with Fade-Matic control, plus Wards new complete line of sound equipment.

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Please send me the new 1949 Photographic Catalog as soon as printed (about May 1).

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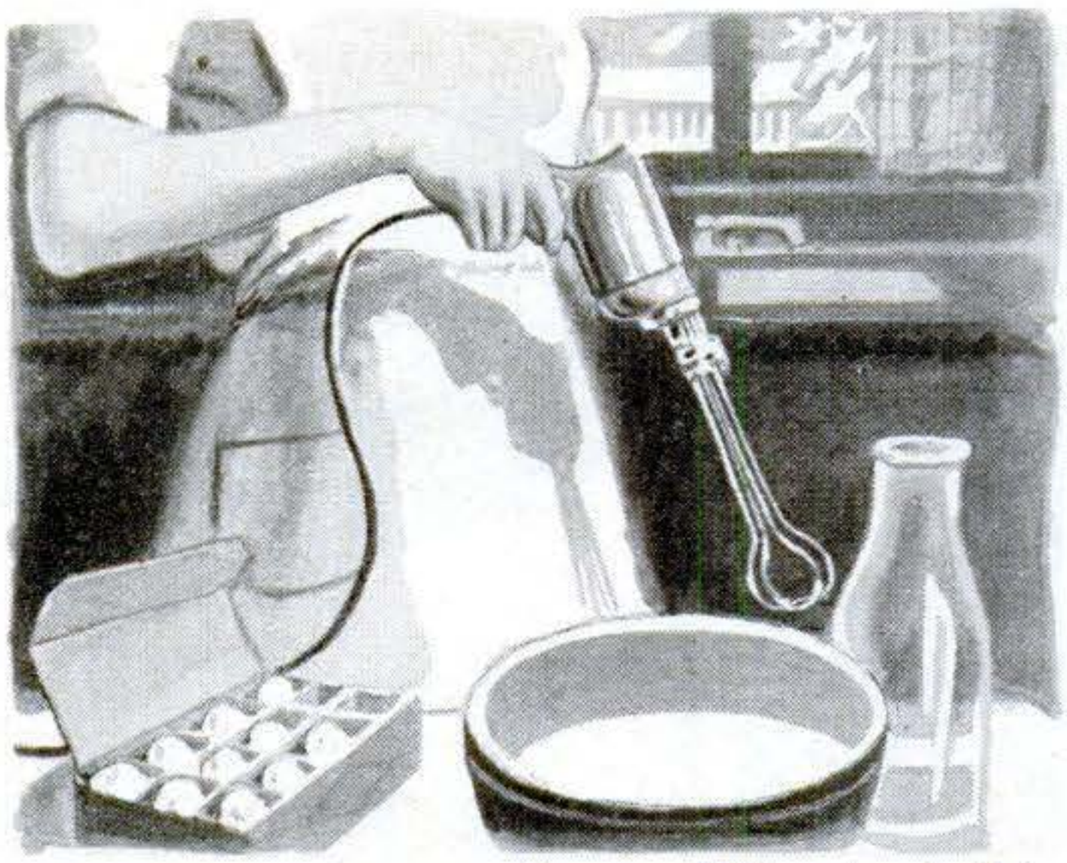
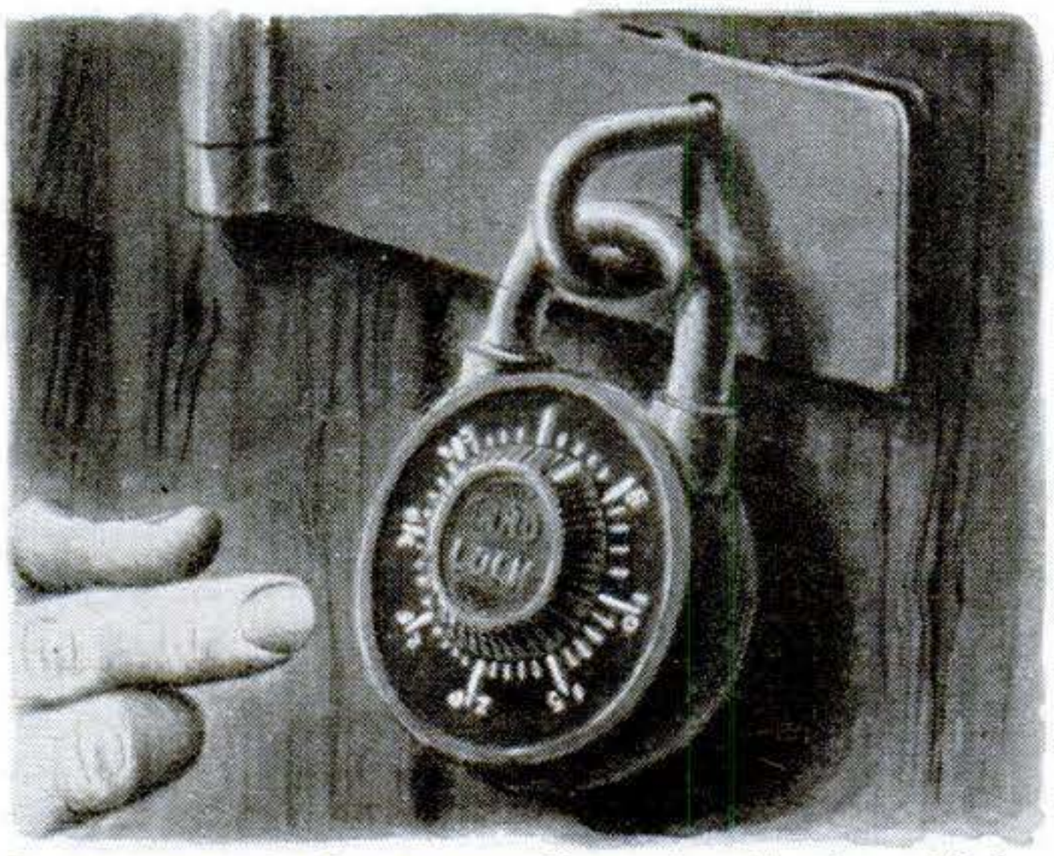
I'd like to see them make . . .

Wheelbarrow bodies that had the bolt or rivet heads flush with the inside. Then the shovel wouldn't be constantly catching on the heads when you shovel out sand or cement.—*Lowell P. Amos, Toledo, O.*



Kitchen attachments that could be chucked in an electric hand drill. A set of such accessories would convert any drill into a mechanical beater and mixer.—*Eric St. Clair, Richmond, Calif.*



Luminous dials on combination locks. If the numbers and pointer would glow in the dark, it would save time not only at night but when used on lockers located in dimly lighted places. —*John P. Bayer, Batavia, O.*

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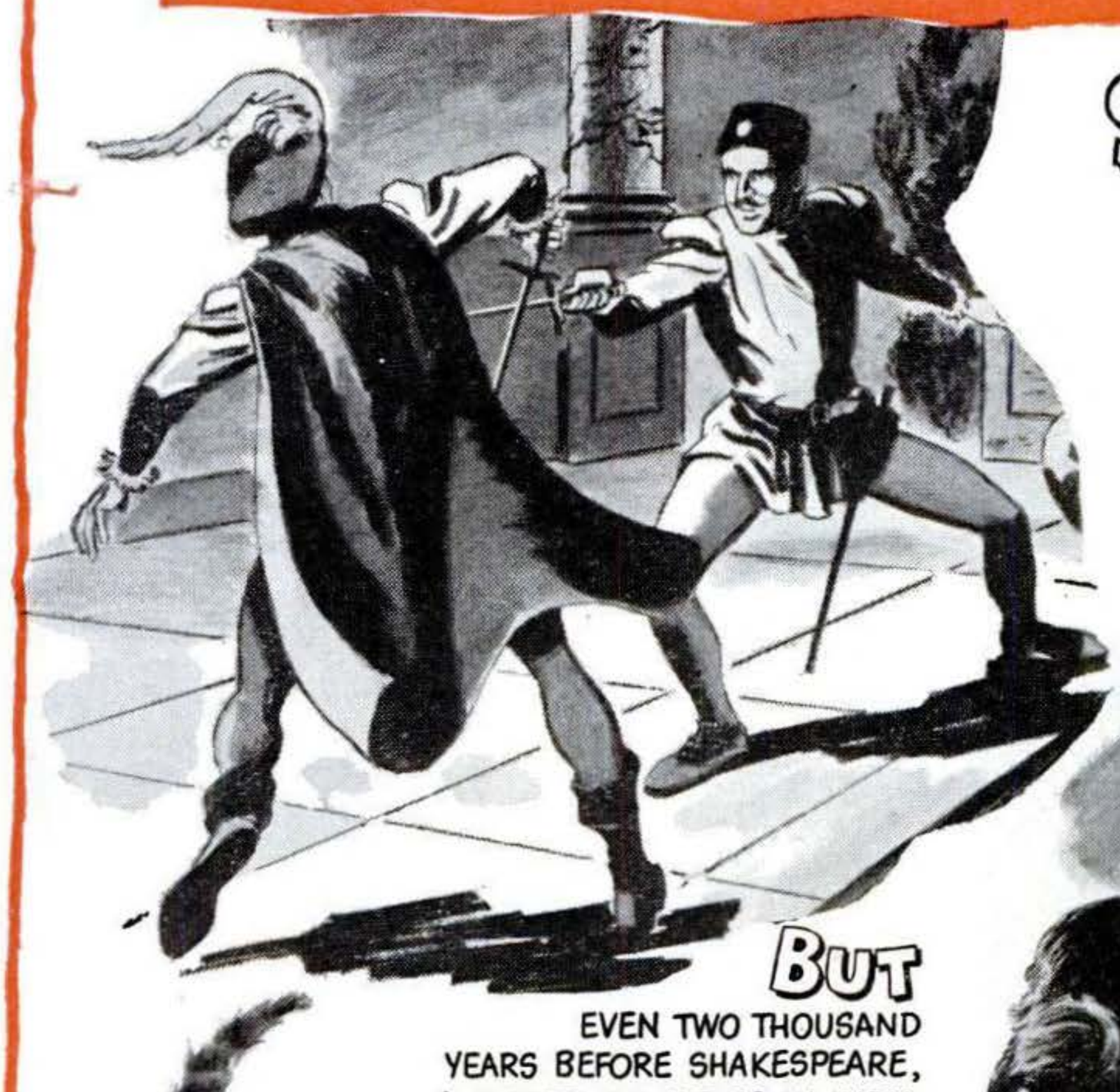
The "9 lives" of a cat by Bers



SHAKESPEARE

MENTIONS THE "NINE LIVES" OF A CAT IN "ROMEO AND JULIET"

TYBALT: "WHAT WOULDST THOU HAVE WITH ME?"

MERCUTIO: "GOOD KING OF CATS, NOTHING BUT ONE OF YOUR NINE LIVES"

BUT

EVEN TWO THOUSAND YEARS BEFORE SHAKESPEARE, A WRITER OF FABLES IN INDIA SAID ABOUT CATS," IT HAS BEEN THE PROVIDENCE OF NATURE TO GIVE THIS CREATURE NINE LIVES INSTEAD OF ONE."

THE ORIGIN OF THE SAYING IS THE CAT'S ABILITY TO "BOUNCE BACK." HE'S TOUGH AND HARD TO LICK. "EVEREADY" BATTERIES HAVE THE SAME SORT OF "BOUNCE BACK." THEY RECOVER POWER BETWEEN USES... **LAST LONGER!** THAT'S WHY THEY'RE CALLED THE BATTERIES WITH "NINE LIVES."

EVEREADY BRAND

THE FLASHLIGHT BATTERY WITH "NINE LIVES"

recovers power between uses!

"Eveready," "Nine Lives," and the cat symbol are trade-marks of

NATIONAL CARBON COMPANY, INC.

30 East 42nd Street, New York 17, N. Y.

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New RCA 16-inch direct-view television tube fills gap between popular 10-inch tubes and the projection-type receivers.

"Inside story" of a bigger, brighter picture on your television screen

The screen on which you usually see television is the face of an electron tube—on which electrons "paint" pictures in motion.

And the size of the picture, unless projected, is determined by the size of the tube.

Working to give you *bigger*, brighter pictures, RCA engineers and scientists developed a new way to make large, direct-view television tubes. They found a method of "welding" large areas of glass and metal . . . while keeping a vacuum-tight seal!

Using this development—ideally suited to mass production methods—RCA can now build television tubes of light, tough metal . . . using polished glass for the face, or "screen."

An achievement of research

Development of this new television tube continues *basic television research* which began at RCA Laboratories. Such leadership in science and engineering adds *value beyond price* to any product or service of RCA and RCA Victor.

Examples of the newest advances in radio, television, and electronics—in action—*may be seen at RCA Exhibition Hall, 36 West 49th Street, N. Y. Admission is free. Radio Corporation of America, Radio City, N. Y. 20.*

RADIO CORPORATION of AMERICA

World Leader in Radio—First in Television

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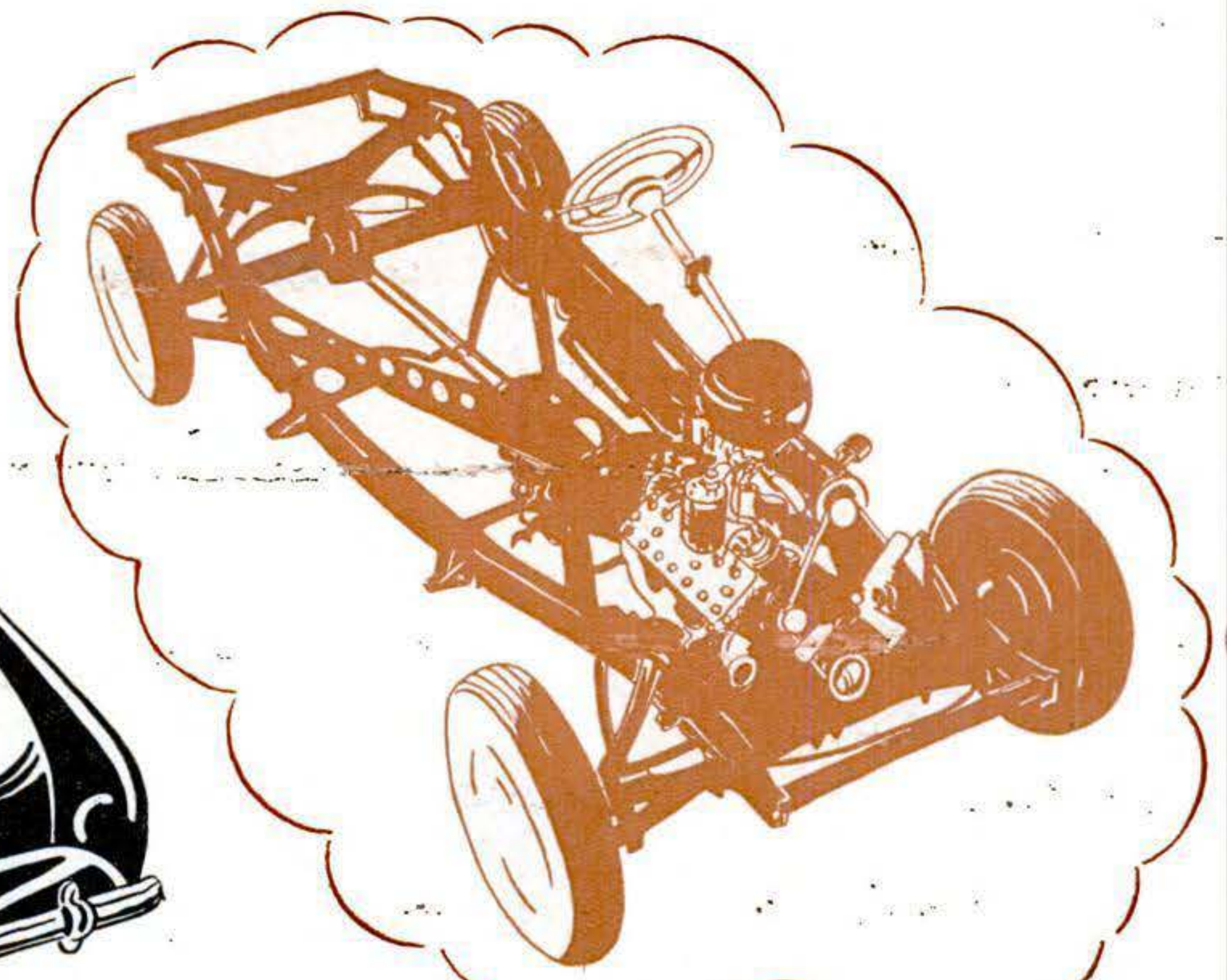

"Mechanic's-Eye View"

THE men who have to fix them have not been exactly happy about the new cars. The stylists and designers have squeezed the engine room so tight that a minor adjustment has become a mechanical and athletic project.

Some owners are reportedly disillusioned about their sleek, new chariots. Bodies, swollen to tenderness, rupture with alarming ease when exposed to the harsh realities of roads and parking lots. Insurance companies and garages have raised their rates.

The automobile industry points proudly to the fact that today's lowest-priced cars carry more people more miles with more power and comfort than yesterday's medium-priced cars. But it is also true that today's lowest prices are up to yesterday's middle bracket. And there is no longer any such thing as low-cost automobile ownership.

The new cars described in this and recent issues are the first, small sign that the industry recognizes realities beyond easy money. The reality that cars must be made for *use*. That they are not going to be parked in the middle of a five-acre field, or driven only on lonely roads. That they are going to be bumped, scraped, and scratched even with the most careful driving. That men with usual-sized heads and hands will have to work on them.

Perhaps truly people-proof cars, short of a cushioned light tank, are impossible. But this particular new-car owner is getting a little tired of listening to manufacturing v.p.'s talks lightly of the safety value of "crumple effect" in swollen sheet steel—at $165 per crump.

And as a stockholder in this country, in the economy of which the automobile is so important, I am happy to note the first steps toward utility and a lower total cost of automobile ownership.

Percy Githerings

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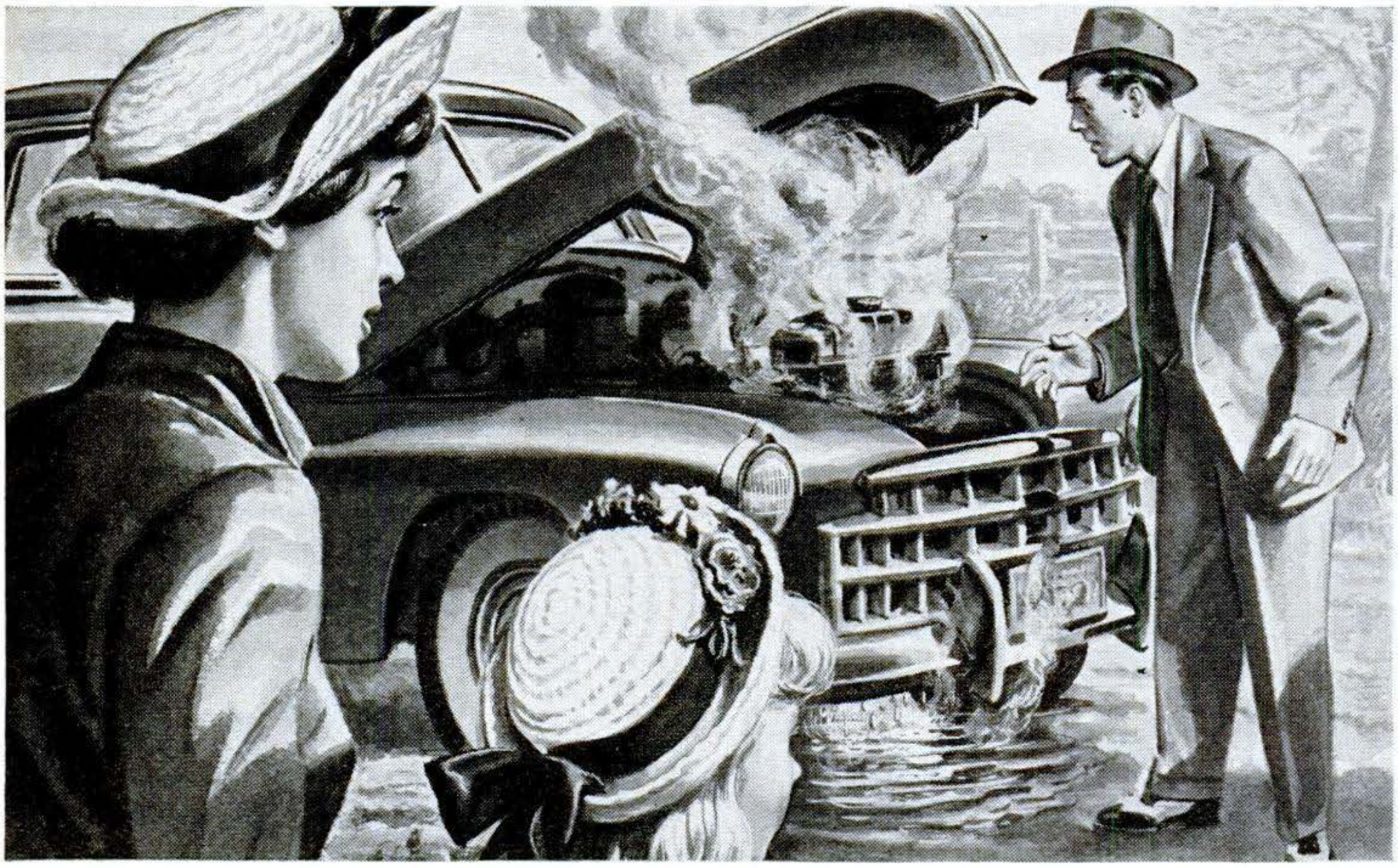
Don't let a rusty radiator take you for a costly ride



Rust-clogged radiators cause overheating, trouble and expense

Clean out rust with

DU PONT COOLING SYSTEM CLEANSER

Get rid of winter's accumulation of rust, scale and scum . . . avoid damage caused by overheating. Just pour a can of DU PONT CLEANSER into your radiator, run the engine 30 minutes or more, and drain. It dissolves rust—cleans thoroughly—improves the engine performance. It's safe, sure and easy to use.

Keep out rust with

DU PONT ACID AND RUST INHIBITOR

After cleaning out the radiator, you can keep it free from rust all season by pouring in a can of DU PONT ACID AND RUST INHIBITOR. It retards rust formation, and keeps out acid, too.

Avoid radiator leaks with

DU PONT COOLING SYSTEM SEALER

You can stop leaks quickly and securely—and help to prevent radiator leaks in the future—by pouring in DU PONT COOLING SYSTEM SEALER. It will not clog the radiator or harm hose or metal parts.

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Better Things for Better Living
. . . Through Chemistry

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POPULAR SCIENCE
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Stairway to Atomic Industry...

These giant steps are really made for a giant—a furnace that will work like the sun. For this is the foundation of the new atomic pile at Brookhaven National Laboratory (story on p. 121), a uranium-and-graphite block encased in a 40-foot cube of concrete about six feet thick. The columns, cast in step design, represent the biggest pour—1,486 cu. yd. of concrete—of the $21,600,000 program.

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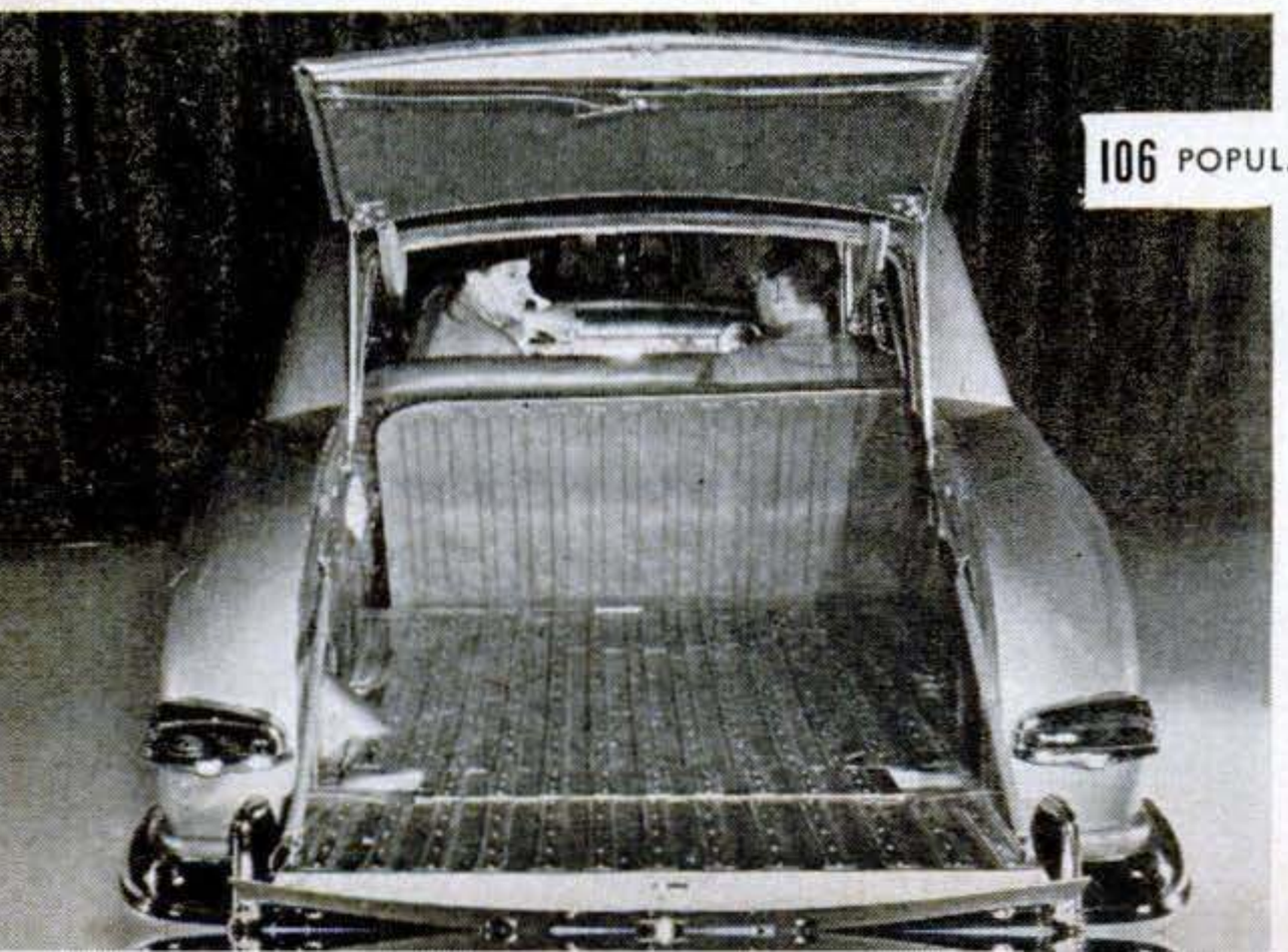
A farm family can use the new utility car both as a Sunday sedan and a workaday light truck.

Back seat is upright in normal sedan position in this view (below) through gaping back. With tail gate closed, the sedan has a stowage space 4 ft. 5 in. long behind the upright seat.



Folding forward of rear seat can be done by driver without leaving his place. Here he is pulling forward the base of the seat, which swings into place against back of front seat.

New Double-Duty Sedan Starts Utility Trend

Cover by Reynold Brown

It looks like a four-door sedan but costs less and will also do the work of a truck.

By Devon Francis
Photos by W. W. Morris and John Frano

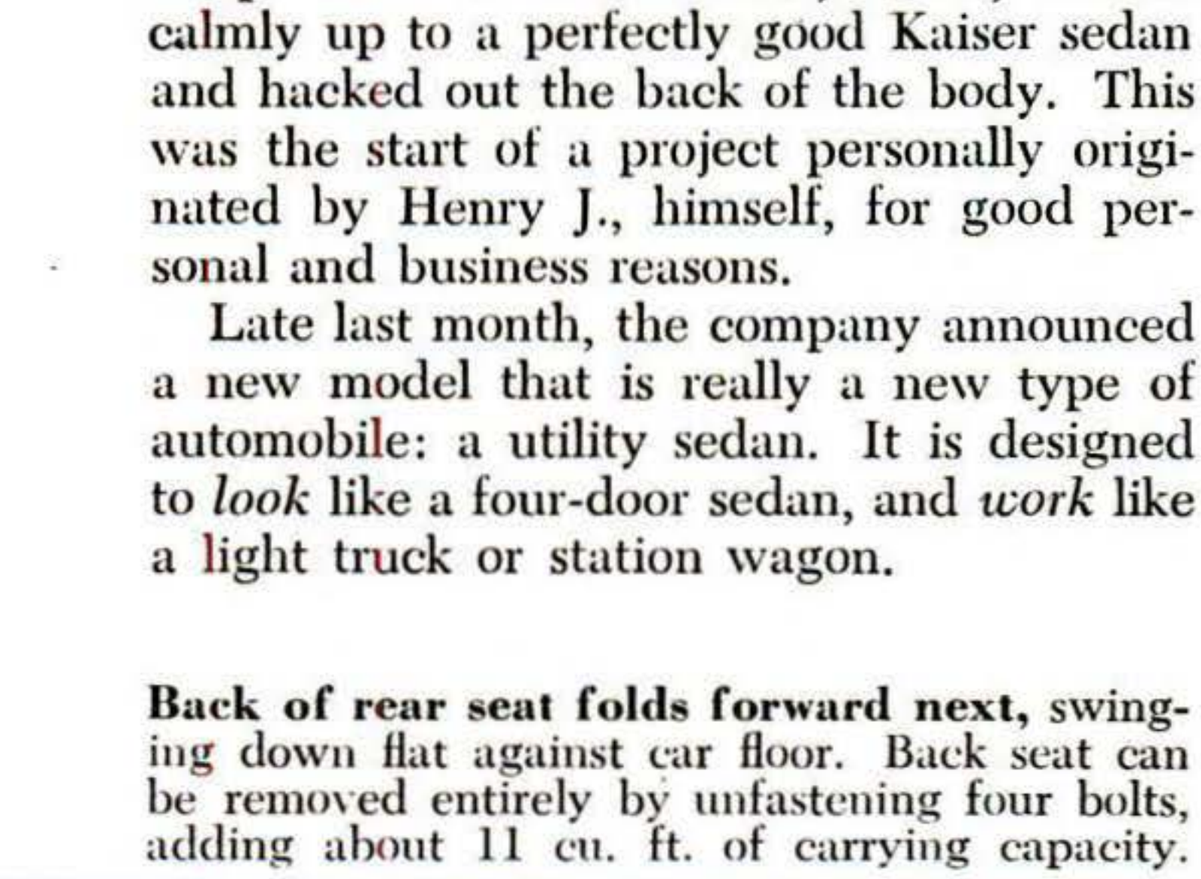
ONE day last summer workmen in the experimental shop of the Kaiser-Frazer Corporation at Willow Run, Mich., walked calmly up to a perfectly good Kaiser sedan and hacked out the back of the body. This was the start of a project personally originated by Henry J., himself, for good personal and business reasons.

Late last month, the company announced a new model that is really a new type of automobile: a utility sedan. It is designed to *look* like a four-door sedan, and *work* like a light truck or station wagon.

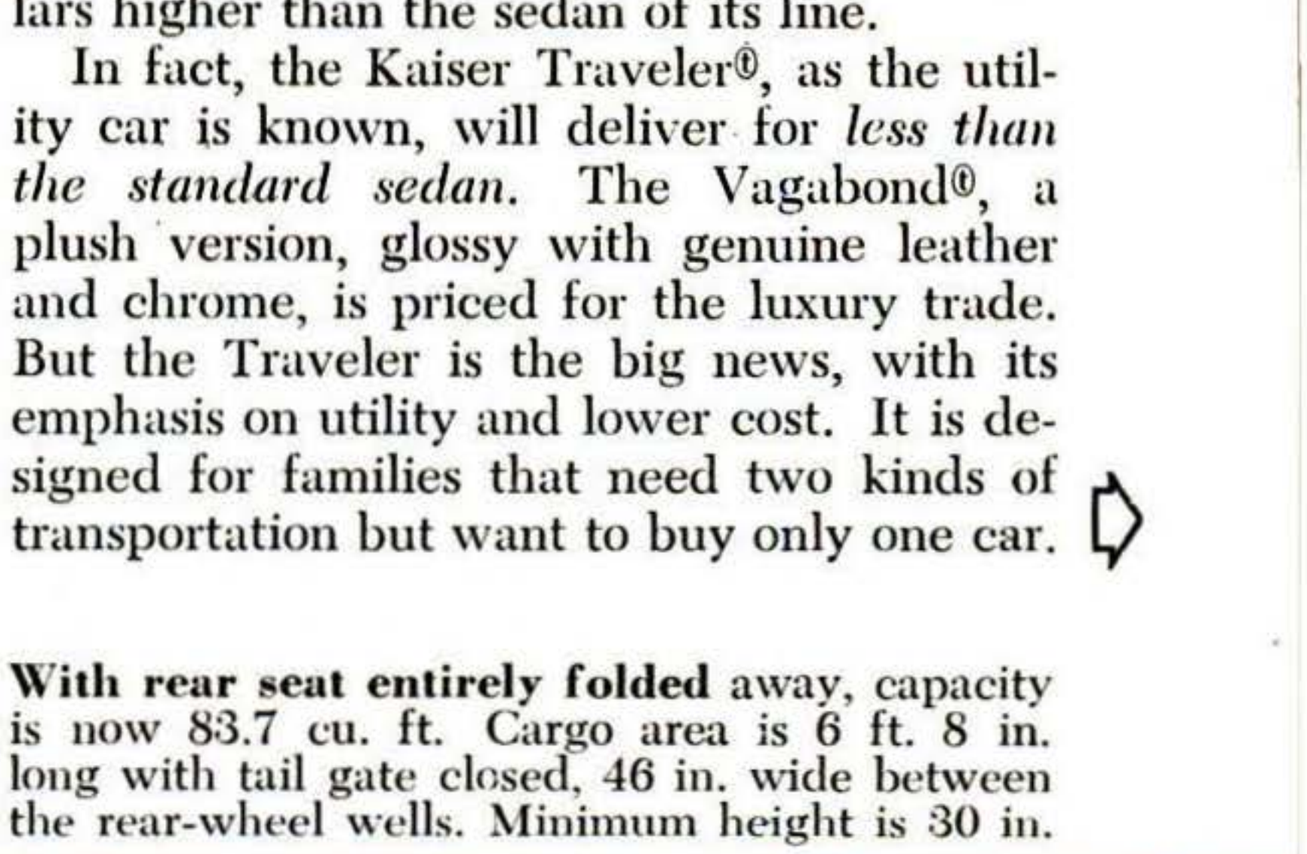
But it is a couple of jumps ahead of the familiar station wagon. It can be changed from standard six-passenger sedan into truck in a few seconds, literally with a twist of the wrist. And it will cost a lot less than a station wagon, traditionally hundreds of dollars higher than the sedan of its line.

In fact, the Kaiser Traveler®, as the utility car is known, will deliver for *less than the standard sedan*. The Vagabond®, a plush version, glossy with genuine leather and chrome, is priced for the luxury trade. But the Traveler is the big news, with its emphasis on utility and lower cost. It is designed for families that need two kinds of transportation but want to buy only one car.

Back of rear seat folds forward next, swinging down flat against car floor. Back seat can be removed entirely by unfastening four bolts, adding about 11 cu. ft. of carrying capacity.



With rear seat entirely folded away, capacity is now 83.7 cu. ft. Cargo area is 6 ft. 8 in. long with tail gate closed, 46 in. wide between the rear-wheel wells. Minimum height is 30 in.



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Like many revolutionary ideas, the one behind the Kaiser utility car is simple. In essence, the designers have opened up the back end of a sedan, hinged it for access, and contrived fittings for the rear seat so it can be folded forward to make a flat floor. This provides a cargo space nine feet long, with tail gate down, and almost four feet wide at its narrowest point, between the wheels.

And like all simple ideas, it wasn't so easy to work out.

This idea began with a beef from the boss. Henry J. Kaiser had been driving a station wagon around his place near Lake Tahoe in the California Sierra. He found it hard to ride as a passenger car, hard to use as a truck. To haul anything, seats had to be wrestled out bodily. Maintenance was high. It squeaked and rattled. It was drafty. He didn't like it. Neither did Mrs. Kaiser. That settled it. A new kind of a car would have to be designed.

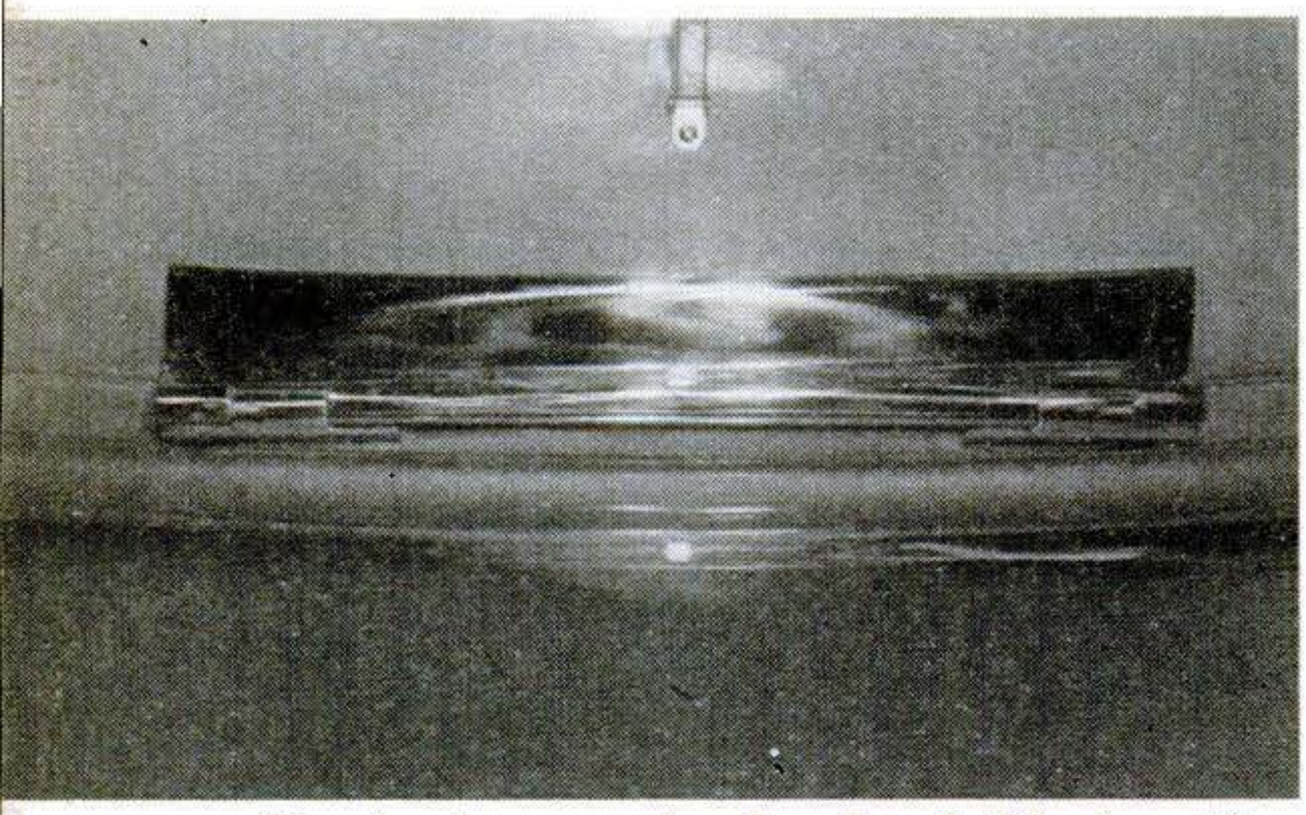
On a July day, 1948, Henry Kaiser telephoned his son Edgar, vice president and general manager of Kaiser-Frazer, at Willow Run.

"I've got an idea," announced the chairman of the board, typically without preface. He expounded on it. "Come on out."

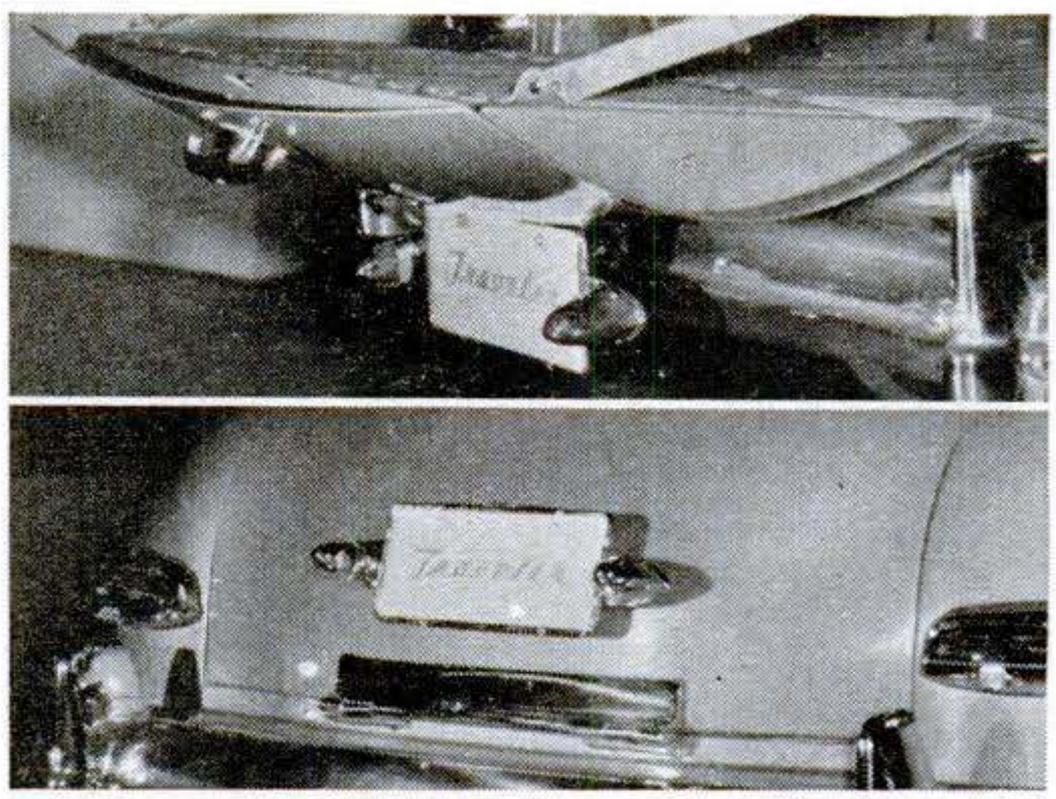
Edgar Kaiser and Dean Hammond, the company's chief engineer, met with Henry in an eleventh-floor office of the Kaiser Building in Oakland. Henry gave them the pitch. They talked. They began calling their creation a "utility vehicle" before they knew what it was going to look like. What they were after was a car that would do a station wagon's work and yet not be compromised as a regular sedan.

"The best way to get at this is to look at a car," said Henry Kaiser finally. "Let's go down to the garage."

They took the elevator downstairs, and on one of the company's standard sedans began drawing lines in the dust with their fingers. The cut on the body could be made here. The hinges might go there. Of course, something would have to be done with the rear seat so it need never be lifted.

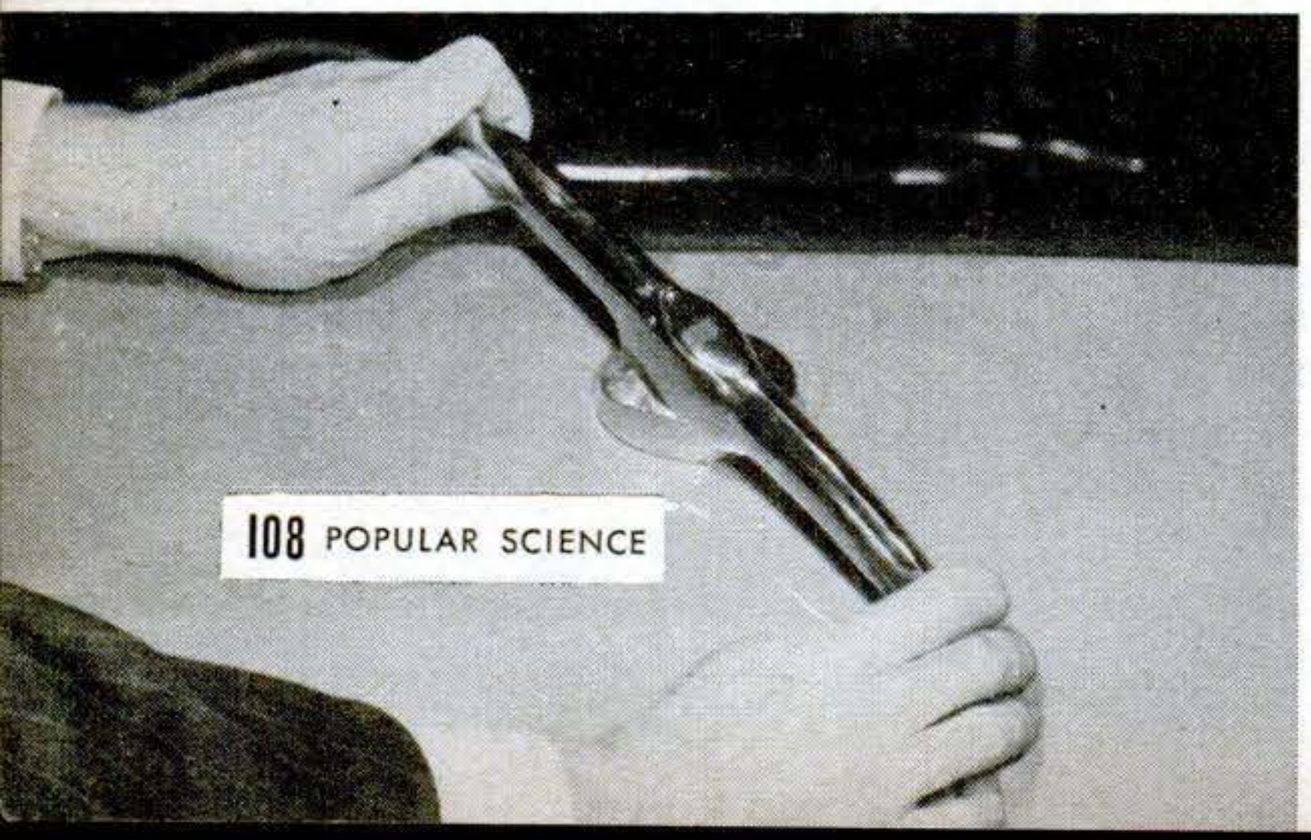


Simple, inexpensive bracket holds the utility car's license plate vertical whether tail gate is up or down. When the gate is lowered (upper right), plate is pulled down by hand. When gate is up (lower picture), spring locks plate in normal position. Sturdy piano-type, 20-in. hinge (left) secures tail gate to body, replacing ordinary strap hinges of conventional Kaiser sedan.



T handle (below) gives leverage for closing, locking extra-heavy lower deck lid. Lower deck is 24 by 45 in. When opened, it's 24 in. off ground with rear springs at normal extension.

Shrouded spare is bolted to dummy left rear door. Rear seat is narrowed to make room for it. The tail-gate chains and upper-lid hinges are covered with vinyl to prevent rattles.



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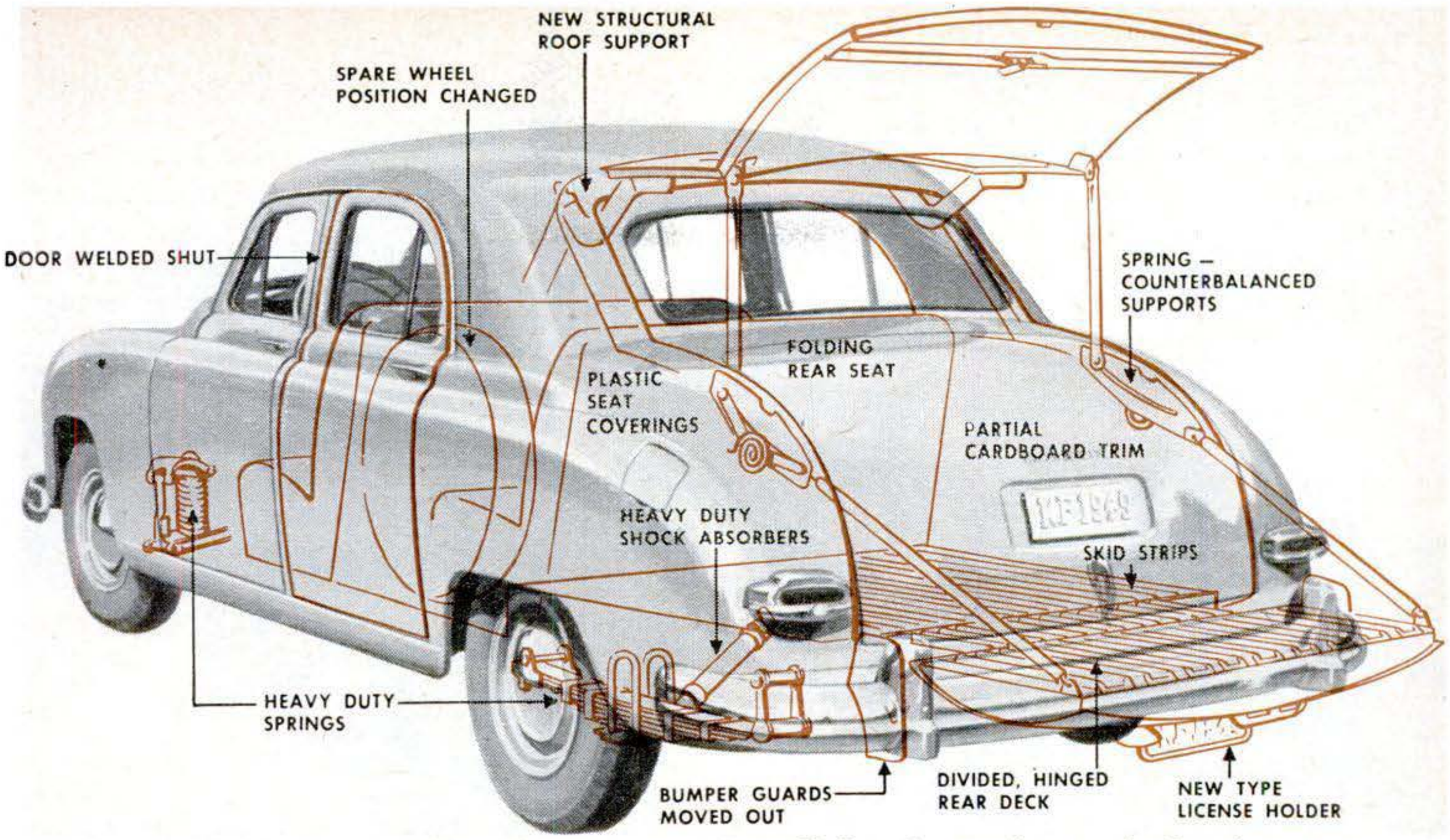


Multitude of changes in utility sedan as compared to standard sedan are partially shown in this drawing. Most prominent in body-support structure are reinforcement strips of 16-gauge hot-rolled steel around top and sides of opening. Car has no rear package shelf. Left rear window and right rear vent window do not open. The front floor covering is rubber-covered jute.

When the walking conference was over, Hammond returned to Willow Run to start experimenting. One provision was mandatory: with the rear of the car closed up, the design must leave intact all the visible and structural features of a standard sedan.

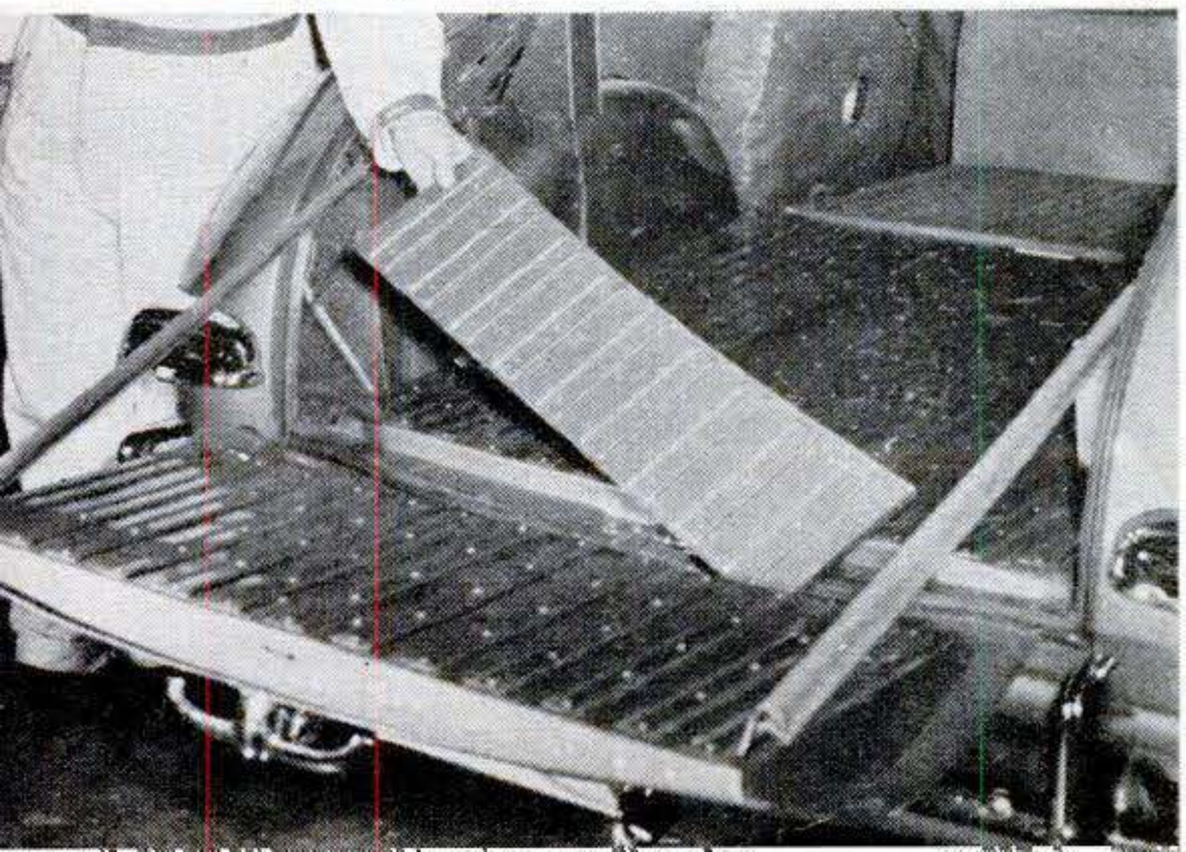
They sheared out the skin at the rear of a sedan body, leaving the rear window untouched. By mid-August they were experimenting with the side hinging of a deck lid. That didn't work. It was awkward. They discussed splitting the door in the center and hinging it at both sides, like the doors of a panel truck. Finally, on September 14, the roof above the rear window was cut into. Then they split the lid horizontally and put the hinges at the top and bottom.

This was it. The production model of the utility car will be substantially as Hammond and Edgar Kaiser devised the hinging and as Henry Anschuetz, head of the development-engineering department, conceived the improved folding-seat plan.

Only 60 days had elapsed from idea to rough prototype.

The idea was simple, all right, but a whale of a lot remained to be done in the design department before the vehicle could be put into production. Big and little, more than 200 changes had to be incorporated into it before the car actually came into being. Springs and shock absorbers had to

Plywood bridge, stripped with metal, is dropped between car bed and tail gate for easier loading. When not in use, the bridge locks under spring clip on left wheel-well covering.



Space behind rear-wheel wells can be used to carry tools and other small items. These stowage spaces are covered with panels secured with quick-release, aircraft-type fasteners.

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Everything for a camping trip—except the cabin—can be packed into the back of the new Kaiser utility sedan. Model shown here is the Vagabond®. Family of four will ride in regular-

Camping and sports gear by courtesy of Fox Tent and Awning Co., Ann Arbor, Mich.

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size front seat. Their equipment includes air raft, outboard motor, collapsible carriage, folding stove, portable ice box, canvas cots. Even the canary can be taken along in sedan-truck.

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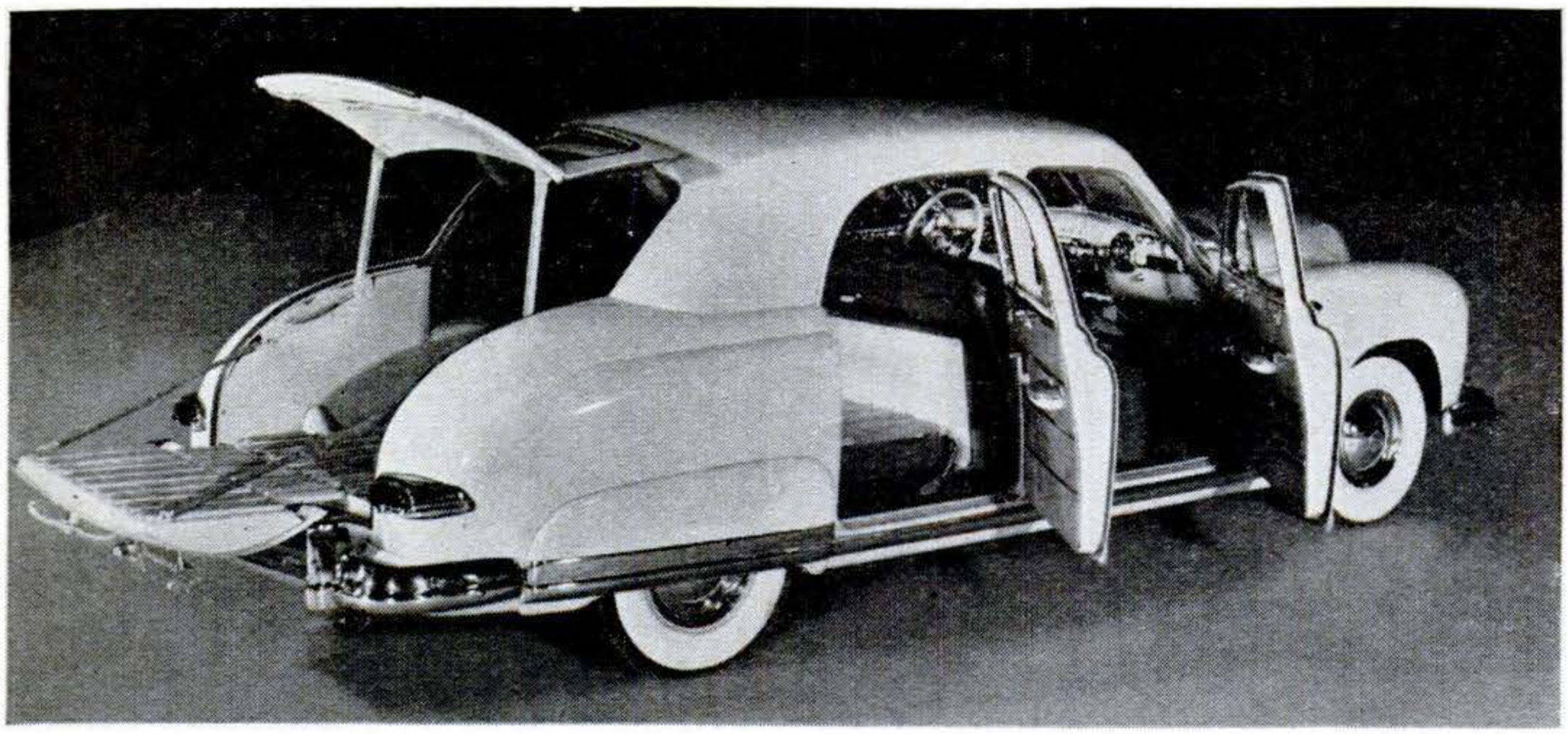

Plushy version of utility car, the Vagabond®, has 112-hp. engine compared to 100 hp. of cheaper Traveler®. It also sports more chrome trim. Rub strips are wood instead of metal. Overdrive is standard on Vagabond. Rear window of both models is 6½ in. narrower than that in standard sedan, whose window line coincides with utility car's rear-end opening.

be beefed up to take bigger loads. Some of the wiring that lay on top of the floor pan in the regular sedan had to be ducted underneath for the utility car so it wouldn't get in the way of a power lawn mower or a roll of barbed wire or milk cans. New piercings had to be made for the rear-window opening and new dies for the whole rear of the body. In shearing the body, all the strength of the wrap-around skin was lost, and a reinforcing member had to be engineered for insertion above the cut.

Fittings Had To Be Strengthened

The lower deck lid was too heavy for opening with a single handle, and a T handle had to be made for it. Its strap hinges had to be replaced with a piano-type hinge if it was to serve as a sturdy loading platform. Hinging and lighting the license plate so it could be pulled down 90 degrees when the tail gate was open and still conform with the laws of 48 states took one engineer's time for weeks. Some economies had to be made if the car was going to undersell the conventional sedan. That meant removing some of the fluff.

Outwardly, and in the driver's seat, the car is the same. Engine and frame remain the same. Wheelbase, clutch, transmission and gear ratios are unchanged. When you sit behind the wheel, the instrument panel looks, and is, exactly like that of the standard Kaiser sedan. The only tip-off is the plastic seat covering, easily washable.

But anyone who tries to open that left rear door will think it is locked. Actually, it's welded shut: the spare wheel and tire had to go somewhere.

The "utility car," is a product of the company's unconventional thinking. The elder Kaiser is a maverick in industry. It was he who produced ocean freighters for war on an assembly-line basis by means of prefabrication. His chief engineer thumbed his nose at tradition fifteen years ago to design an airplane that almost anyone could learn to fly with an hour's instruction. All the K-F officials are from the same stamping mill.

And yet: "You know, our hardest job on the utility car," commented H. V. Lindbergh, manager of styling, "was in overcoming the feeling that it couldn't be done." And yet: a new segment of the market has been tapped; two new models have been added to the dealer's line without the crushing expense of a major model change.

Needless to say, Henry J. Kaiser will have one of his new utility cars at Lake Tahoe as soon as he can get one off the assembly line. END

Bulb Burns Three Years

A LAMP only 1/25 as big as a penpoint, made by Westinghouse, will burn continuously for three years. Its red-orange glow will indicate whether your electrical appliances are operating and guide you to fuses and outlets.

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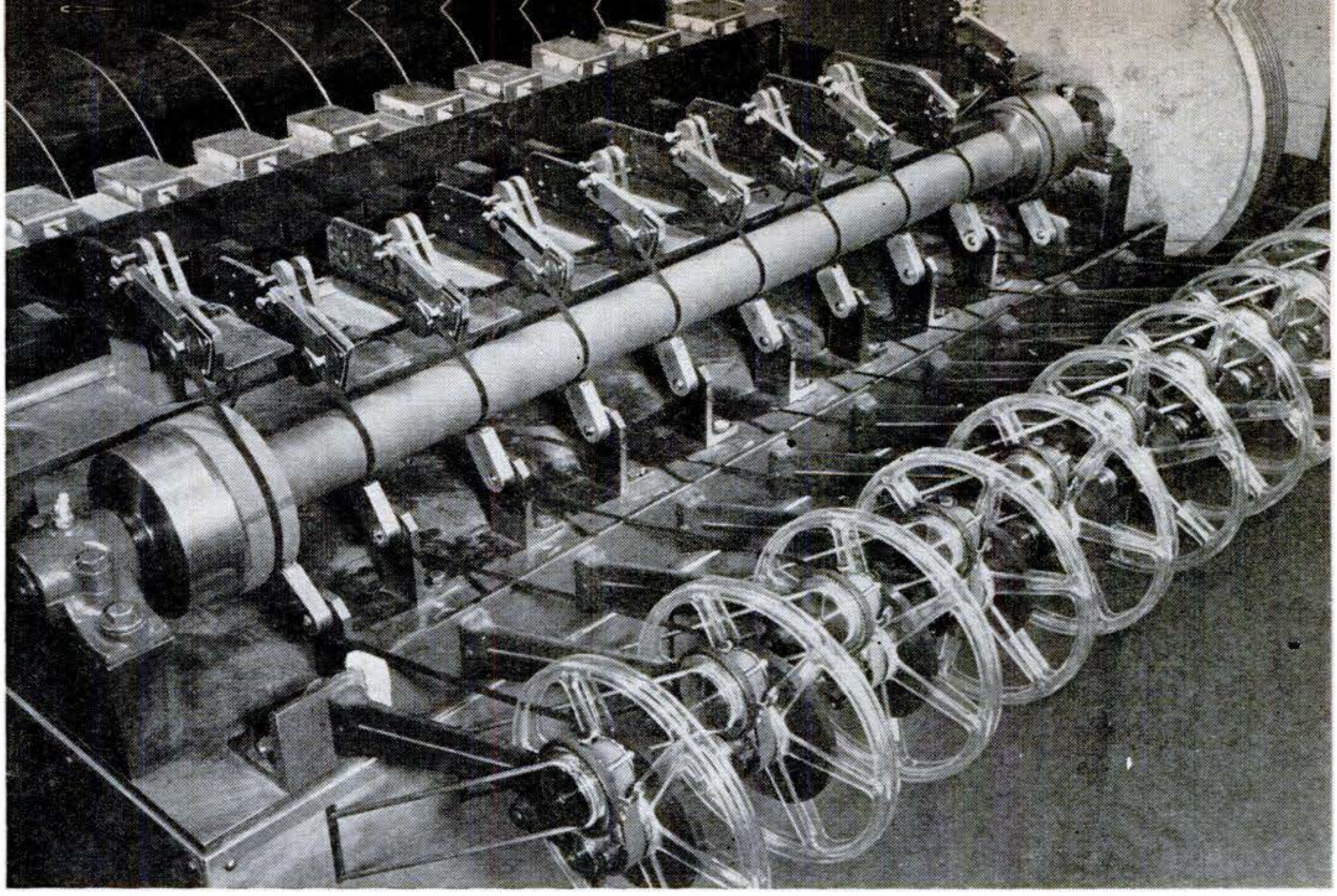
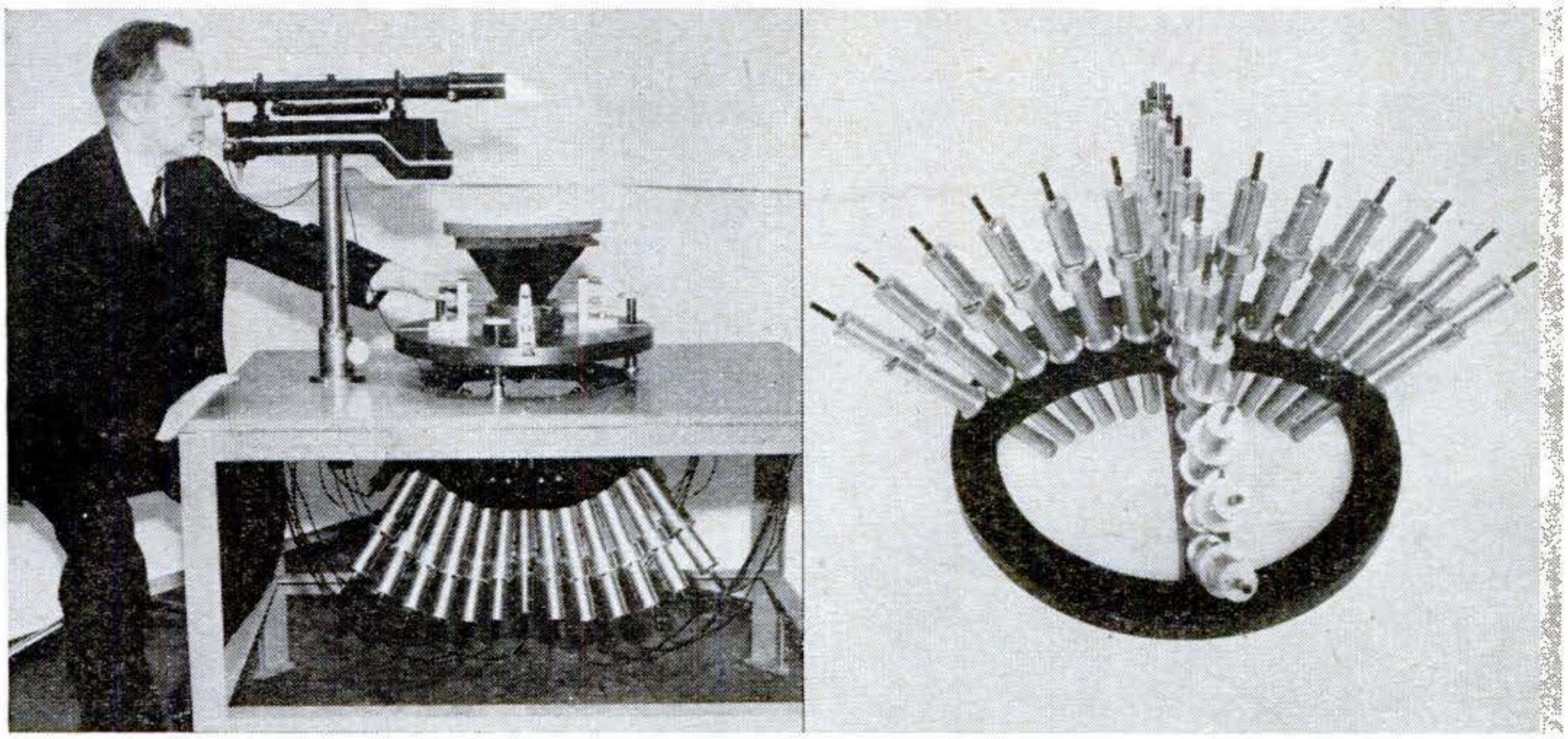


Tape Records Mass-Produced

THIS multiple tape recorder removes the last obstacle to commercial recordings on magnetic tape—the mass production of duplicate tapes. It makes eight duplicates at once at three times normal speed. It can also record two sound tracks on the same tape at the same time. Thus the machine can turn out eight hour-long recordings in 10 minutes, or 48 an hour. Signals from a master tape are amplified and then fed into recording heads, shown above. A common capstan keeps the master and copy tapes at the same speed. In playback, one side of the double sound track plays as the tape reel unwinds, the other as it winds up. Minnesota Mining and Mfg. Co. made it.



Parallel Light Tests Lenses

THE spiked, crownlike object at right is the heart of a new Bureau of Standards device to test the lenses of aerial cameras. It consists of 25 collimators arranged in a cross to cover the entire field of a lens. Light rays passing through the 25 tubes are rendered parallel to simulate actual sunlight. To test a camera, placed on the table at left, 25 tiny beams of light are shone up through its lens and into a collimating telescope above. This light pattern, magnified by the telescope, provides an accurate check on the focal length, distortion, and resolving power of the lens.

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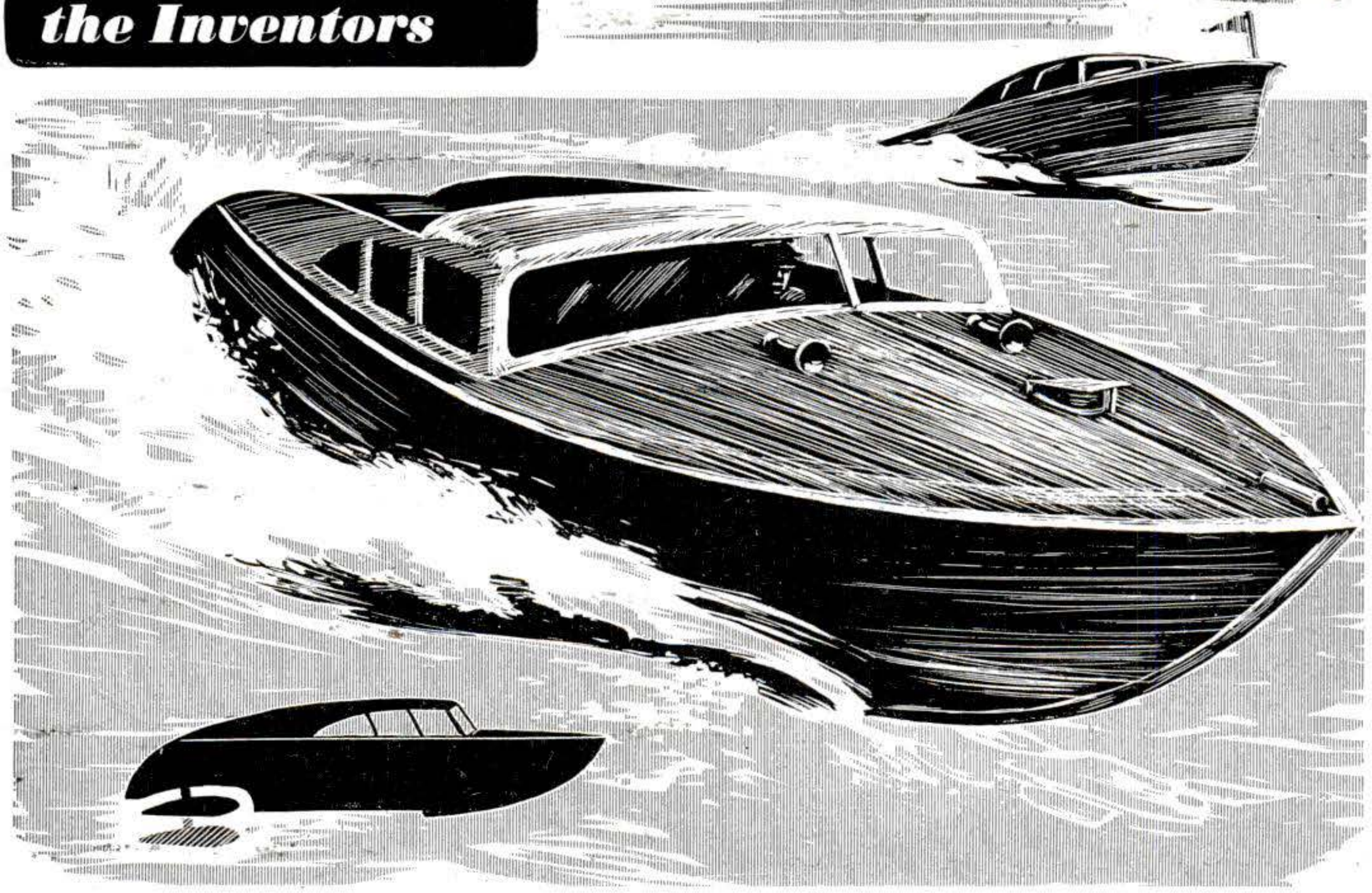
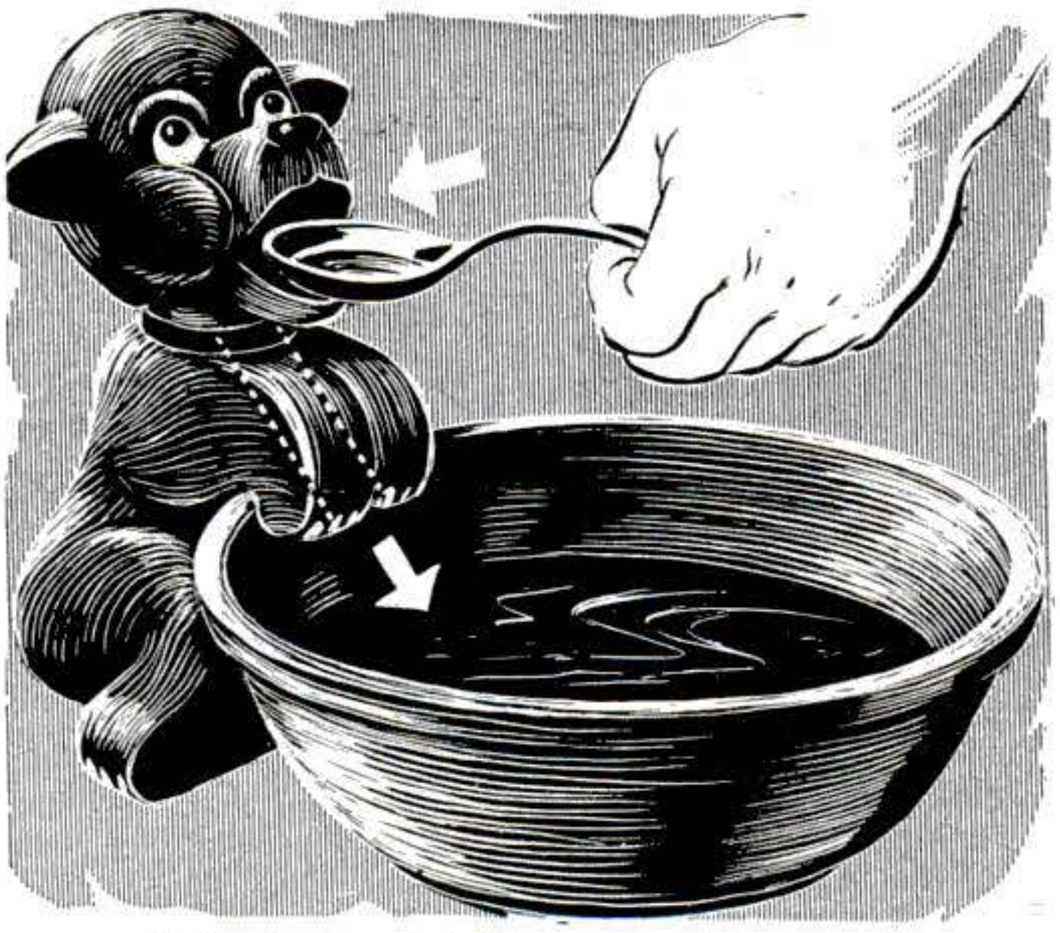
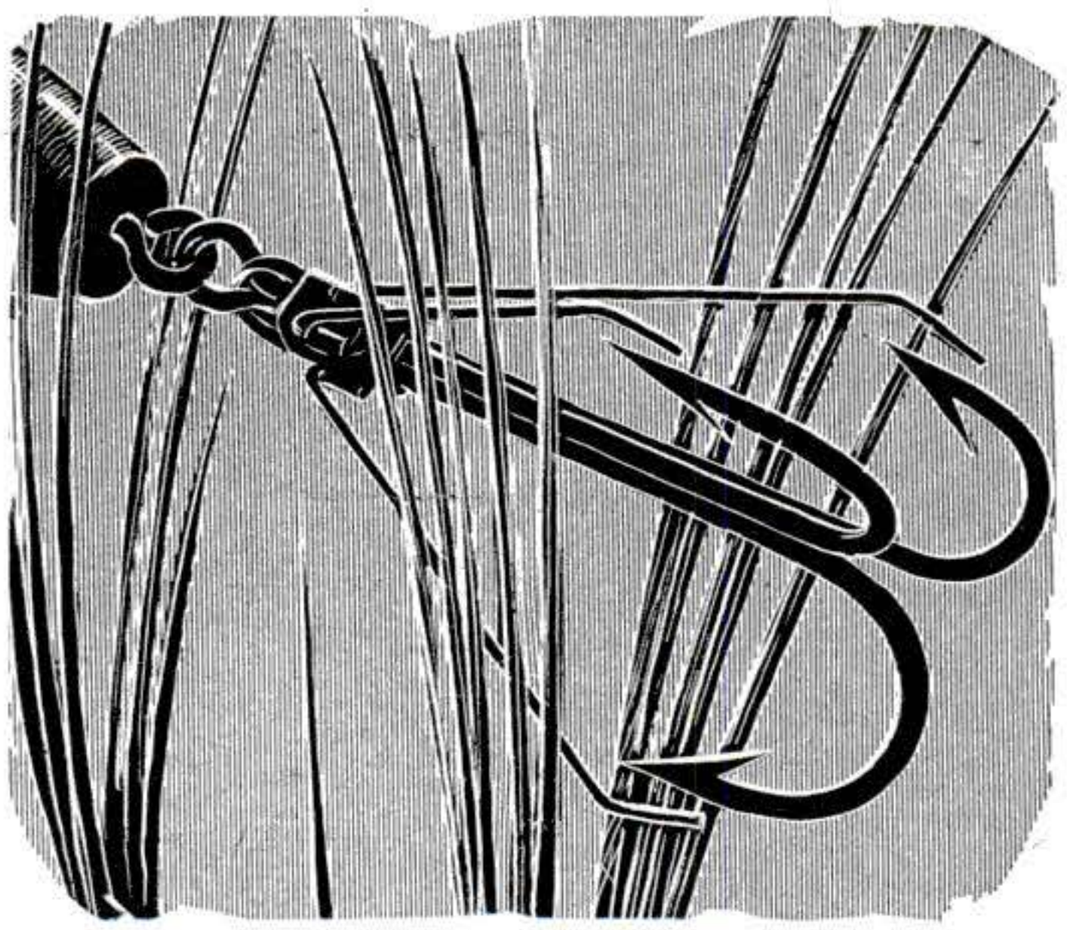
New Ideas from the Inventors



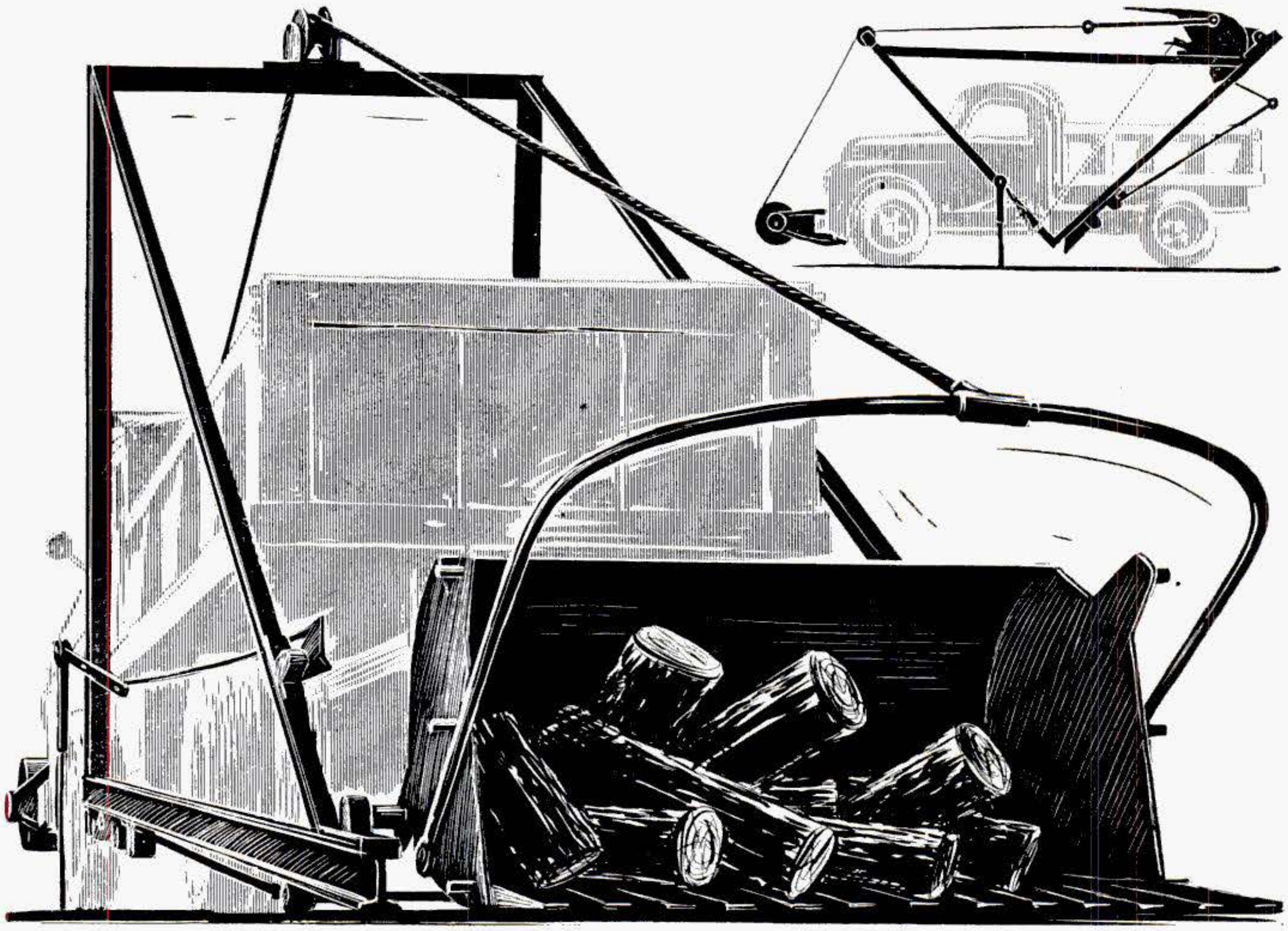
Boat Pontoons Cut Drag. A pair of pontoon floats keeps this speedboat skimming flat over the water instead of dragging at the stern with its bow in the air. They swivel under the stern, and are lowered hydraulically as the speed increases, raising the stern and permitting greater speed. Invented by E. W. Berger, of San Diego, the floats can be manually operated or automatically controlled by the speed.



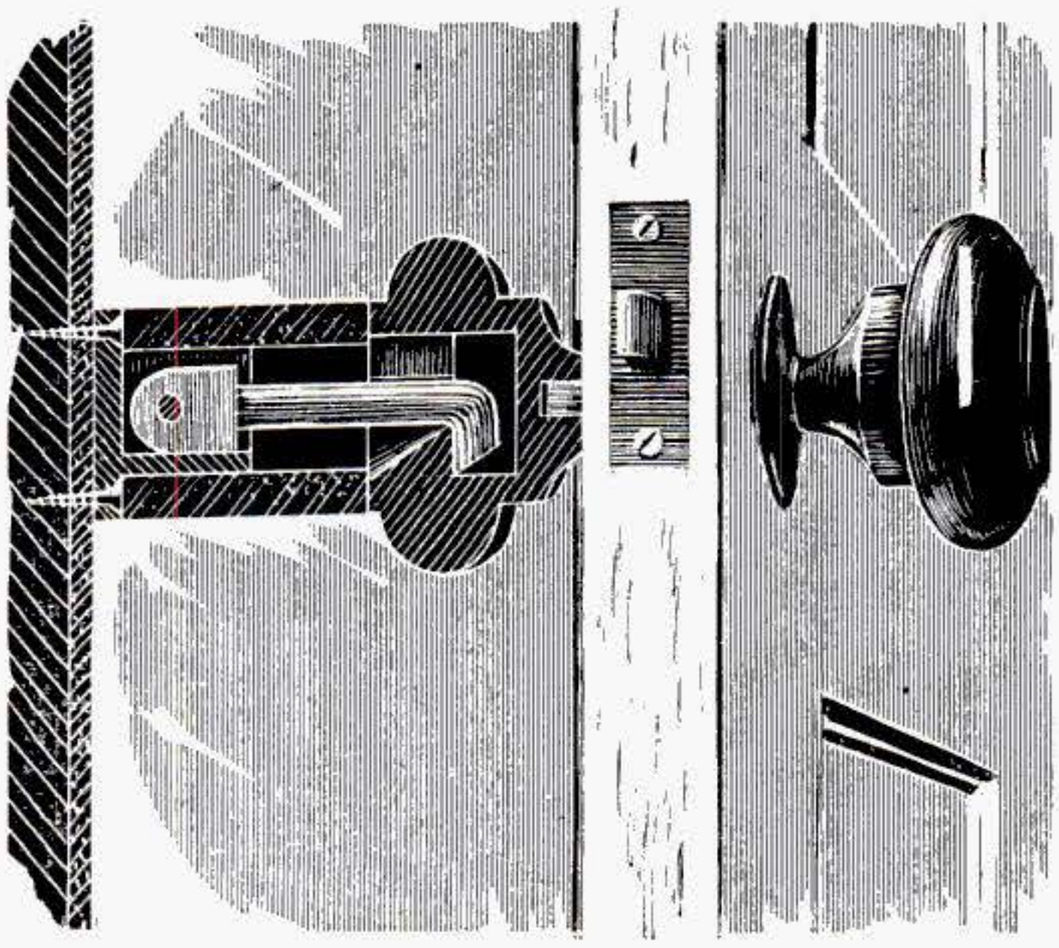
Food Dish Aids Appetite. Junior might get more fun out of eating—and eat more—if he used this dish with a toy dog on the rim. One bite for Junior, one bite for Fido—only Junior ends up eating it all, because Fido's food runs back into the dish through a tube in the front paws. It was invented by B. B. Manaster, of Chicago.



Hook Guard Stops Weed Snags. Fish, but not weeds, will cause you to feel a tug on your line if you use this hook. Fine, spring-steel wires shielding the hook's points allow it to slip through weeds or over obstructions without snagging. When a fish strikes, the wires are pushed inward. The inventor is H. M. Heimark, of Oak Park, Ill.

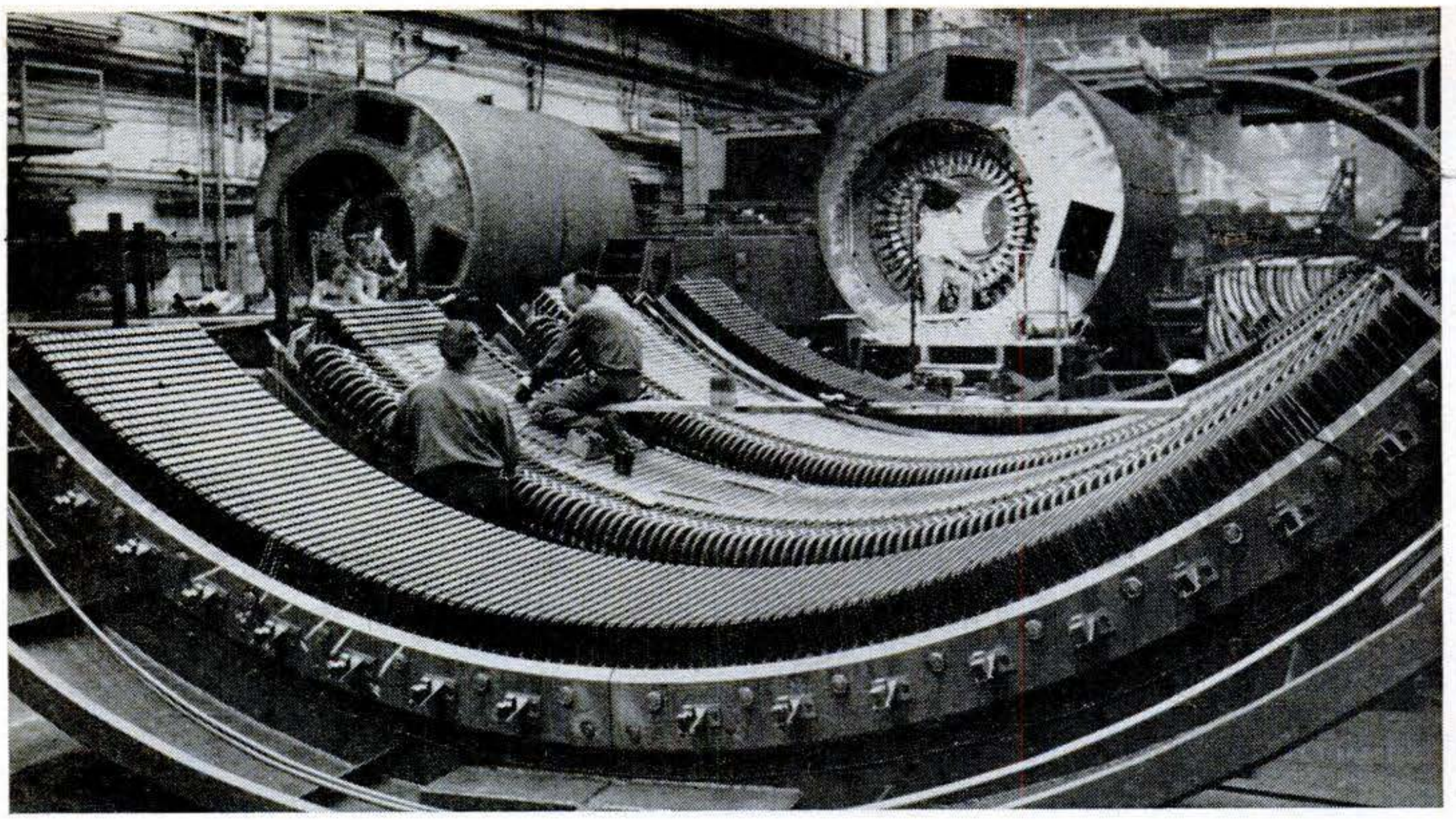


Truck Loads Itself. The driver of this truck can pick up a load without ever leaving his seat. The large triangular frame, pivoted at the center of the truck, holds a scoop bucket at its rear end. When a powered winch on the front of the truck pulls the bucket, the whole frame tips forward, like a seesaw, raising the bucket over the truck and dumping its contents. The loader was invented by S. Smith, of Bend, Ore.



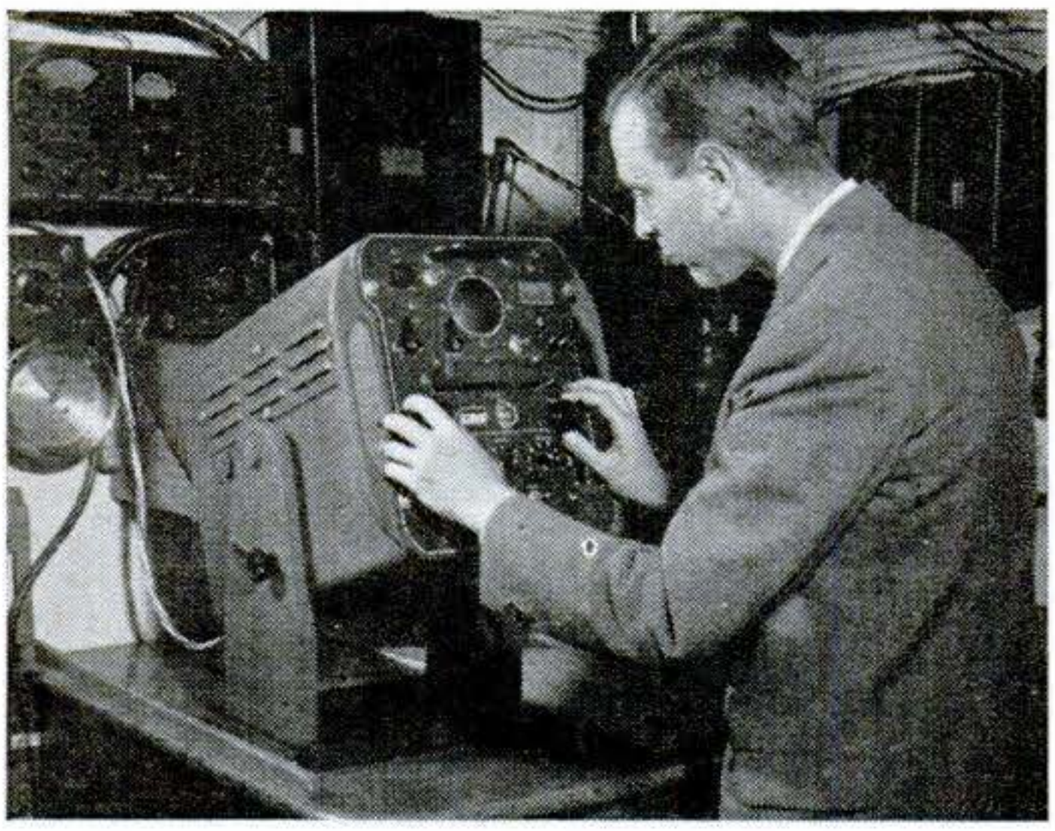
Wall Latch Holds Door. This novel doorstop, patented by A. J. Harris, of Long Beach, Calif., automatically holds a door open when it's pushed against the wall. A hook in the wall slides into an opening in the doorknob and locks over a ridge. Giving the knob a half turn slides the ridge from under the hook, releasing the door.

Chin Jabber Wakes Drivers. You shouldn't fall asleep at the wheel with this chin jabber on the job. Worn around the neck, it holds a sharp prong under the driver's chin. If his head nods, the point quickly awakens him. Invented by K. H. Liman, of Rye, N. Y., it has a rubber knob below the tip to prevent serious injury.



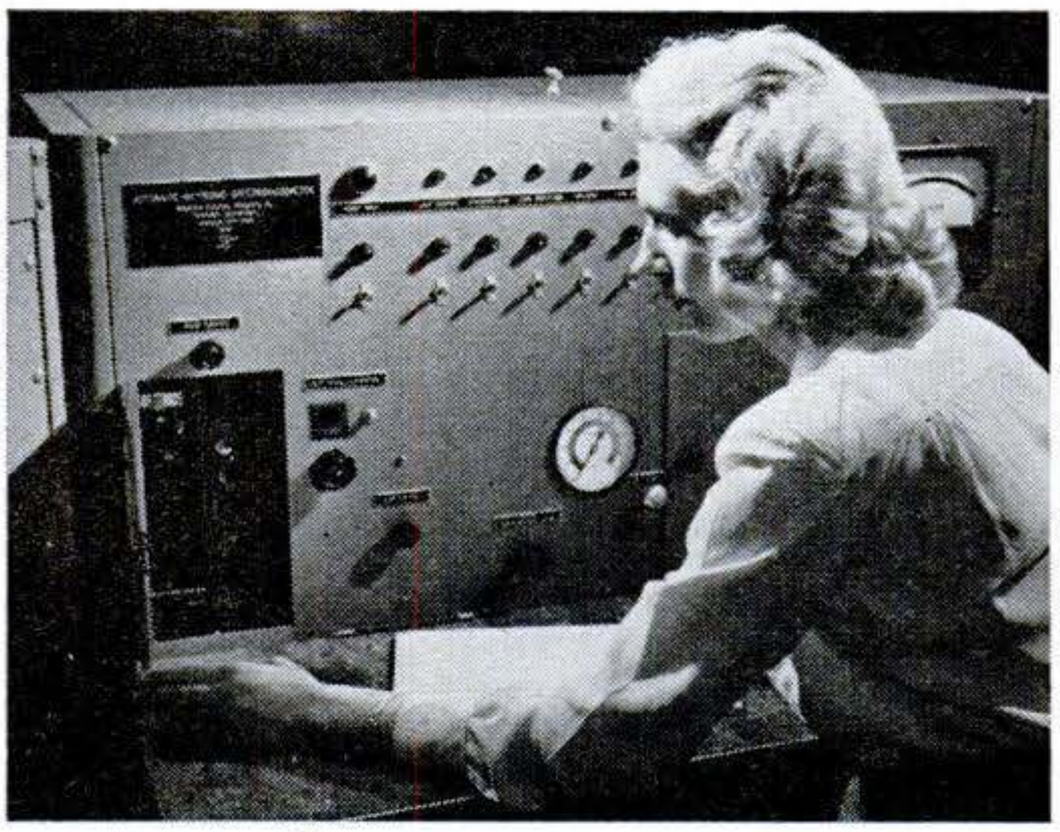
Putting a Generator Together

THE four enormous metal segments in the foreground above are part of a huge waterwheel generator being constructed at Westinghouse's East Pittsburgh plant. Each section weighs 43,000 pounds. When all four are put together, they will form a horizontal ring 30 feet in diameter and 6 feet high. This will be the stator, or stationary part, of a 430-ton generator. This monster will produce 28,000 kw. of electric power, enough to supply about 56,000 homes. In the background are two steam-turbine generators.



New Loran Aids Fishermen

FINDING your way to profitable fishing grounds in any weather is no trick with this table-model loran. Small size is only one advantage of the new electronic navigator, according to Sperry Gyroscope Co., its designer. It is also easier and faster to operate than earlier models. Skippers within range of shore-based transmitters can accurately fix their position at sea in less than five minutes, without having to check sun or stars. The Army Transport Service and the U. S. Coast Guard have ordered the equipment.



Meter Tests TV Tubes

YOU will probably never use the recording spectroradiometer shown above, but its application in the laboratory may result in clearer images on your home television screen. It is a new scientific instrument that accurately plots the full range of visible light produced on a television viewing-tube screen. Sylvania Electric Products, Inc., which developed the device, says that it is fully automatic and will do the job of analysis in 48 seconds: old hand-plotting methods required half a day.

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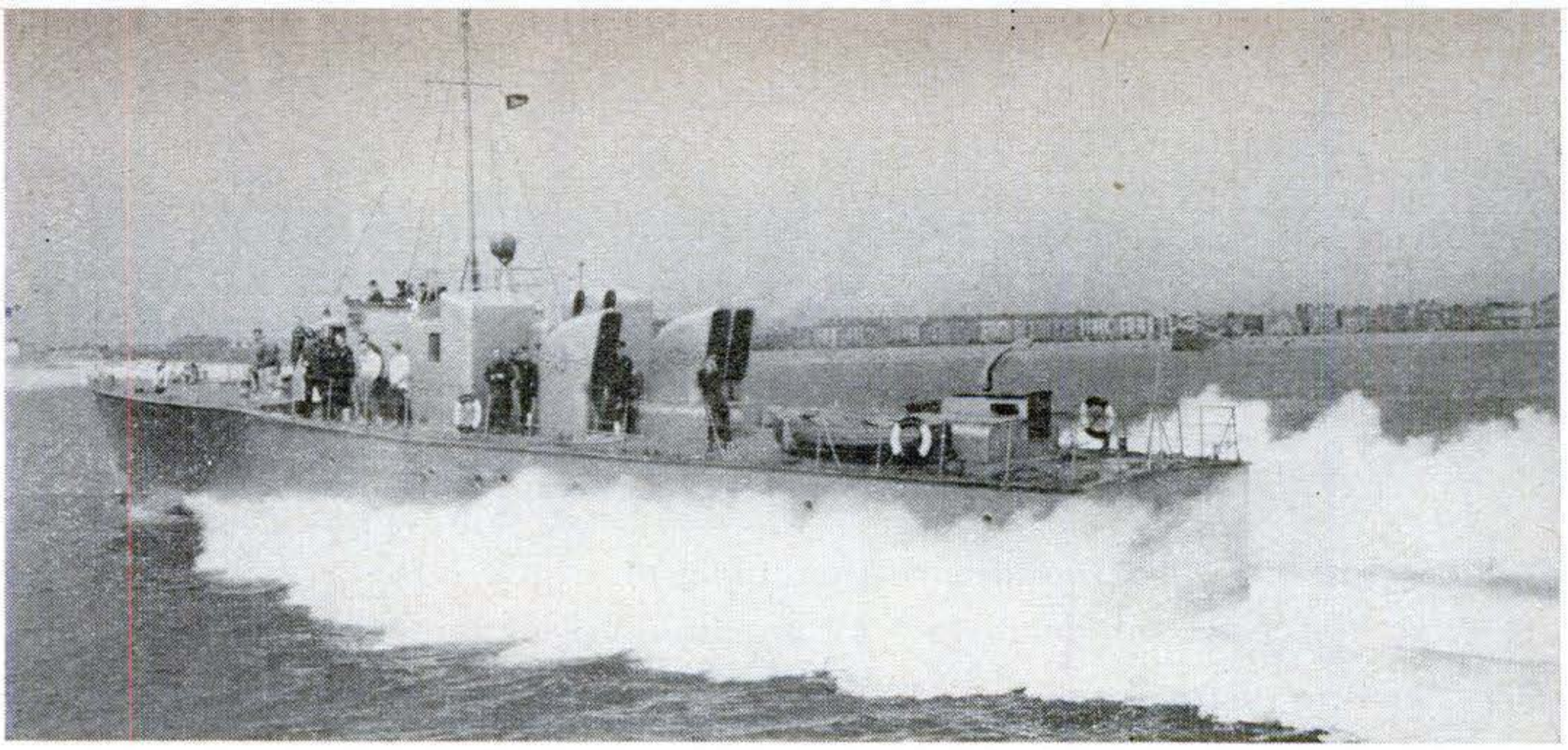

Rescue Boat Built Like Plane

THIS new British air-sea rescue craft, the *Celerity,* has nearly everything she would need to fly except wings. Four 1,675-hp. radial, air-cooled aircraft engines drive four variable-pitch propellers. And her superstructure and most of the fittings are of a light, aircraft-type alloy.

Because the air-cooled engines require no bulky water-circulating systems, there's more room for rescue gear and fuel in the 105-foot craft. It has a top speed of 40 knots and a range of 4,200 sea miles. The variable-pitch propellers need neither clutches nor reverse gears and, being individually controlled, increase maneuverability. When cruising on only one or two engines, the idle propellers can be feathered, like those of a plane, to cut drag.

The 80-ton craft, armed and partly armored, was built by the Bristol Aeroplane Co.

New Fins Lighten Radio Tube

THE weight of this 25,000-watt radio-broadcasting tube was cut from 225 lb. to 98 lb. by using aluminum instead of copper for its cooling fins. This was made possible by aluminum-to-steel bonding, developed to lighten airplane engines. The fins are brazed to a steel hub that, unlike aluminum, can be soldered to the copper anode.

New "Iron Lung" Is Portable

THE Blanchard Portable Respirator®, in use above, permits a patient who needs mechanical help in breathing to be treated in any hospital bed. Its Plexiglas® vest, shaped like a coat of medieval armor, seals at neck, shoulders, and waist with rubber ties that leave legs and arms free. The motor-pump unit (on floor) plugs into any outlet.

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Tires Without Tubes Come Back into Style

A radical new design, immune to punctures and blowouts, modernizes the "pneumatics" of motoring's pioneer days.

By Myron Stearns

A NEW tubeless automobile tire, puncture-sealing and highly resistant to blowouts, has been developed by the B. F. Goodrich Company. Its makers expect that it will eventually change all tire manufacture, which today amounts to about 80-million truck and passenger-car tires a year.

And so, after 53 years, tires without tubes are back in style. The first American cars placed on the market, Cleveland-built Wintons, used overgrown bicycle tires that held air in the same casings that rolled upon the road. But the 1896 rubber was unequal to the task, and tires with easily repaired and replaceable tubes soon superseded the crude tubeless casings, which were good for only 500 miles. Now the cycle is complete, and inner tubes may become as outmoded as a Model T.

Recently the owner of a car equipped with the new tires left it at a service station to be greased. While it was up on a hydraulic hoist, a mechanic called his attention to a nail in one of the casings.

"Want it changed?" he asked.

"Let's have your pliers a moment," the motorist countered. He pulled out a long nail. The mechanic waited for the air to hiss out. It didn't.

300 Punctures—No Leak

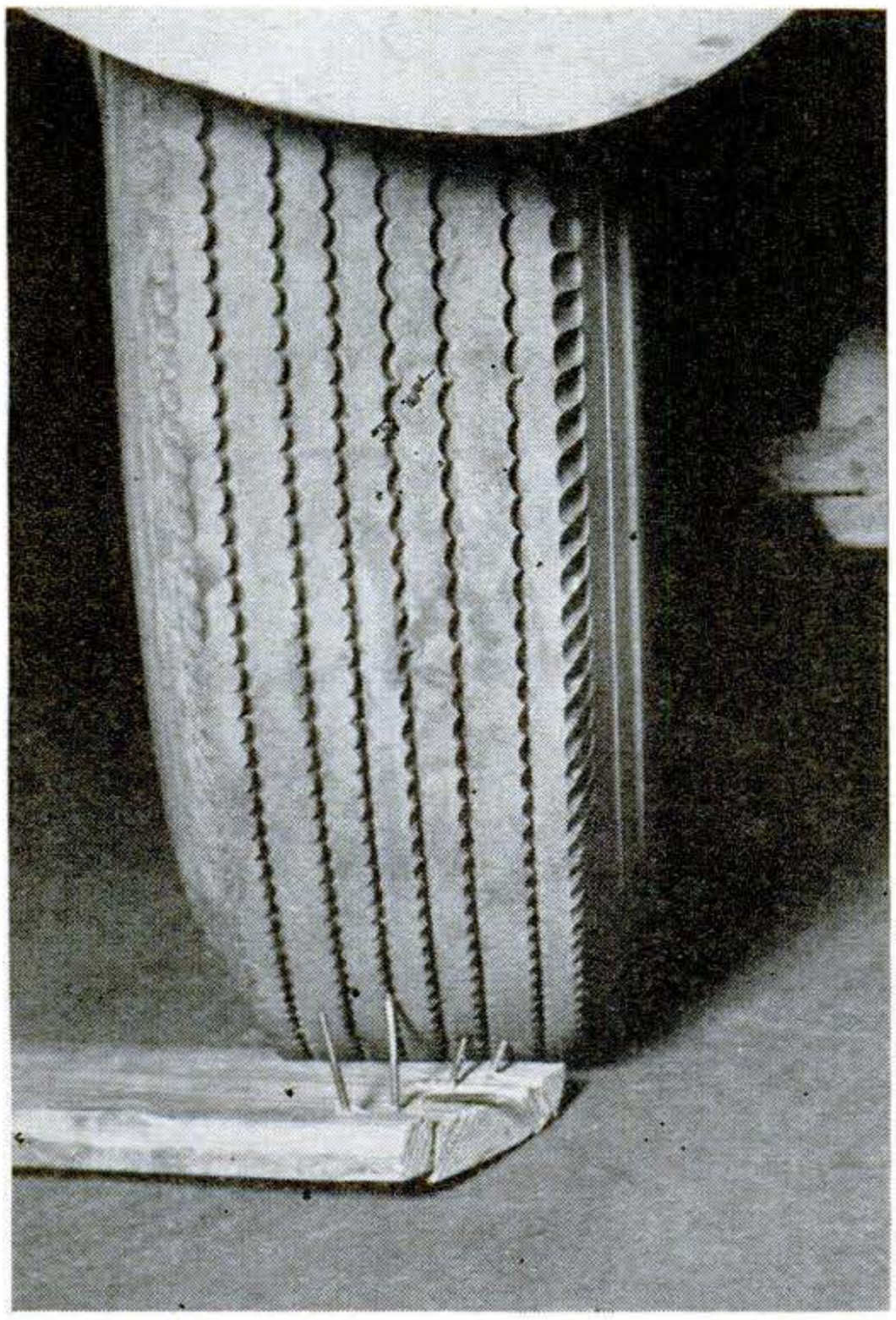
For the benefit of a newsreel photographer, one of the new tires was run 50 times over a board that had six big nails sticking out of it. That meant some 300 "punctures," and it lost no air.

In a car equipped with tubeless tires an Indiana state trooper was on a chase, throttle to the floor, when a loud clack-clack-clack against the concrete pavement began. Instead of slowing up or stopping, he kept on and got his man. Then he investigated. A three-inch-long bolt had driven into a front tire. He simply pulled it out and drove back to headquarters.

Tubeless casings have been tried out on taxicabs in Dallas, Tulsa, Cincinnati, and Philadelphia. Florida state police, as well as Indiana troopers, have been using them.

They *can* be wrecked, but it's difficult to do. Half a broken beer bottle, cutting a two-inch hole, might conceivably ruin them. One went flat when a short piece of half-inch tubing went through it, making a half-inch metal vent.

After the fabric in an ordinary tire becomes damaged, the tube inside holds air until the chafing against the broken tire



New tubeless tire runs over plank studded with nails, completely piercing all its layers, in convincing demonstration of its ability to sustain repeated punctures without loss of air.

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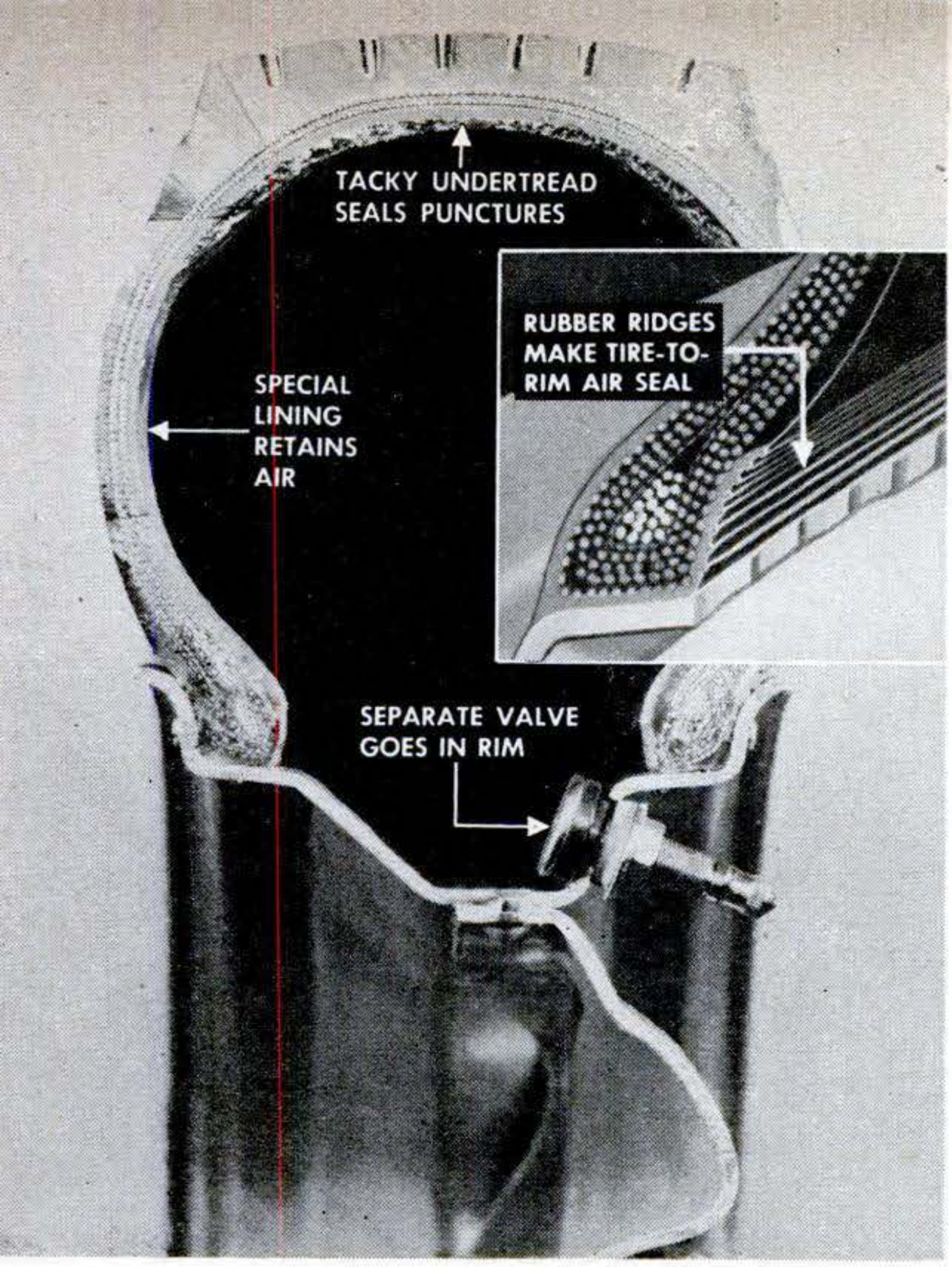

Sawed-through section of tubeless tire on rim illustrates its special features. In inset diagram, part of rim is omitted to show ridges, on outside of tire, that form air seal against it.

cords is too great. Then it "blows out" just as a child's rubber balloon explodes. But in a damaged tubeless casing, the air begins to leak out slowly. There's no sudden letdown.

Efforts to make tires blowout-proof have been going on for years. Initially they concentrated on the tube. Since the '30s the Goodyear Tire and Rubber Company has had a premium-priced, double-lining inner tube called Lifeguard® on sale. At the New York World's Fair ten years ago the Goodrich company exhibited tubes with a "sealing" layer of soft, partially vulcanized rubber that immediately closes any small opening. Bullet-proof gasoline tanks that carried our warplanes through enemy gunfire used the same principle. But the greater cost of the safety tubes, about four times that of ordinary tubes, held them back. With tubeless casings, a good share of the greater-price barrier has been overcome.

The new tires, in the most widely used size of 6.00 x 16 inches, are sold for $24.95. That falls between the ordinary-first-class casing-and-tube cost of about $19 and the ordinary-casing-plus-safety-tube cost of about $28.

In the long decline of tire-mileage costs, that is not bad. In 1920, when tires would stand up for 12,000 miles, the tire cost per 1,000 miles was about $2.25. In 1947, with an average life of 25,000 miles, the tire cost per 1,000 miles for the most popular sizes was only about 60 cents. The tubeless-tire cost for the average family motorist should be about 70 cents per 1,000 miles. Some have already been driven more than 40,000 miles.

By gripping firmly against the steel rim of the wheel itself, the new casing holds air without the necessity for any air-containing inner tube. It seems to make the car ride a little more smoothly than other tires. You can't loosen it from the rim by banging it against a curbstone or rock. An ordinary valve, such as regular inner tubes have today, is held in place in the customary hole in the rim by nuts screwed tight against two rubber washers. This separate valve with its special seal is provided with each tubeless tire sold. The new tires are inflated to the same air pressure as standard ones—28 pounds for the 6.00 x 16 size.

Idea Born from War Needs

The inventiveness and ingenuity of a young technical engineer, Frank Herzegh of Cleveland, are responsible for the new tire development. He personally persuaded the Goodrich higher-ups that a single tubeless casing would eventually prove superior to the more complicated casing-and-tube combination. His efforts have guided it through years of experimental work and at last into successful production.

His first idea for it grew directly from meeting combat-tire requirements during the war.

Even before Pearl Harbor, our Government had asked tire manufacturers to develop a battle tire that could be run flat for at least 75 miles, after being riddled with bullets or shell fragments. Both Germany and France had made one filled with sponge rubber. It was excellent for battle use, but on long hauls it got too hot and became worthless after a few hundred miles. Improving on it, the British reinforced the side walls of a tough, air-filled tire with extra rubber that would last for 50 miles of running flat.

In November 1941 our first experiments with similar combat tires began in Florida, on the Tamiami Trail. They were not good. The best tire ran only 22 miles. Buckets of water had to be kept handy for putting out fires when the tormented rubber blazed up.

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But eventually, with better and better rubber compounds for side-wall reinforcement, we got tires that could run flat for 150 miles. Part of General Patton's smashing success in his rapid advance through France and into Germany was due to American combat casings. His troops and equipment could be moved even faster than the Germans'.

The tough rubber lining that made combat tires last even when they were run flat gave Herzegh his idea—not for running on flat tires, but for eliminating the tube.

"Since the lining extends all around the inside of the casing," he reasoned, "and keeps air out of the fabric, why not have the tire fit tightly enough against the rim to hold in air and use no tube at all?"

Herzegh first got his air-seal idea in January 1942. He soon developed casings that would hold air satisfactorily. The tires on his car have had no inner tubes since 1942.

First tests were run in March of that year. Industry-wide tests followed, since all valuable rubber ideas were pooled during the war. The tubeless tires were tried out on military maneuvers. Then the idea was tossed on the scrap heap—because it required difficult precision work.

The Man Who Wouldn't Quit

Herzegh might easily have quit in discouragement. After more than a year and a half of work, much of it seemingly successful, leading tire experts said he was wasting his time. But he persuaded his superiors to keep on experimenting to develop tubeless civilian tires.

Literally hundreds of different rubber compounds were worked with to get a thin lining in place of the thick linings that made combat tires last when they were run flat. It had to stick properly to the inside of the casing under all conditions of flexing and heat. After almost endless experiments, butyl rubber, developed by the Standard Oil Company (New Jersey), proved to be the answer. A tenth-of-an-inch thickness of it will hold air as well as a solid inch of ordinary rubber.

At first, to make the rim airtight, Herzegh inserted a big circle of thin soft rubber, as large as the wheel itself, between the rim and the casing. It worked; but unless it was placed just right, the air leaked out. These experiences led to a one-piece, self-sealing tire with rubber ridges along the outside of the bead where it rested against the rim.

The first tubeless tires for civilian use were tried out for about a year before the extra layer of gum rubber was added to make them puncture-sealing. Even after that a lot of testing had to be done.

Frank Herzegh, young engineer who developed the new tubeless tire, shows above how its valve is attached separately on rim. The rim itself forms part of the air-retaining chamber.

Until February of this year the tubeless tires were sold in only two areas, around Indianapolis and Cincinnati, while production was tried out on a small scale. Production has been built up slowly, because both factory handling of the new carcass-construction techniques and servicing of the new product by tire handlers must be thoroughly learned. Filling-station attendants have had to know, for example, how good a rim must be to hold air satisfactorily with the new shoes; if it is bent, or too badly pitted with rust, the air will leak out.

This February the new casings were put on sale in Florida, so that car owners in three states are now able to buy them. During 1949 all five Goodrich plants will be turning out the new tires in quantity for national distribution. "As the demand mounts," the Goodrich officials say, "we will be able to step up production to meet it." And they add that at least three of their competitors are already working feverishly on tubeless-tire problems. END

Sound Carries 90 Miles

UNDER freakish atmospheric conditions, the sound of gunfire from a U. S. battleship during target practice has been heard distinctly at a distance of more than 90 miles.

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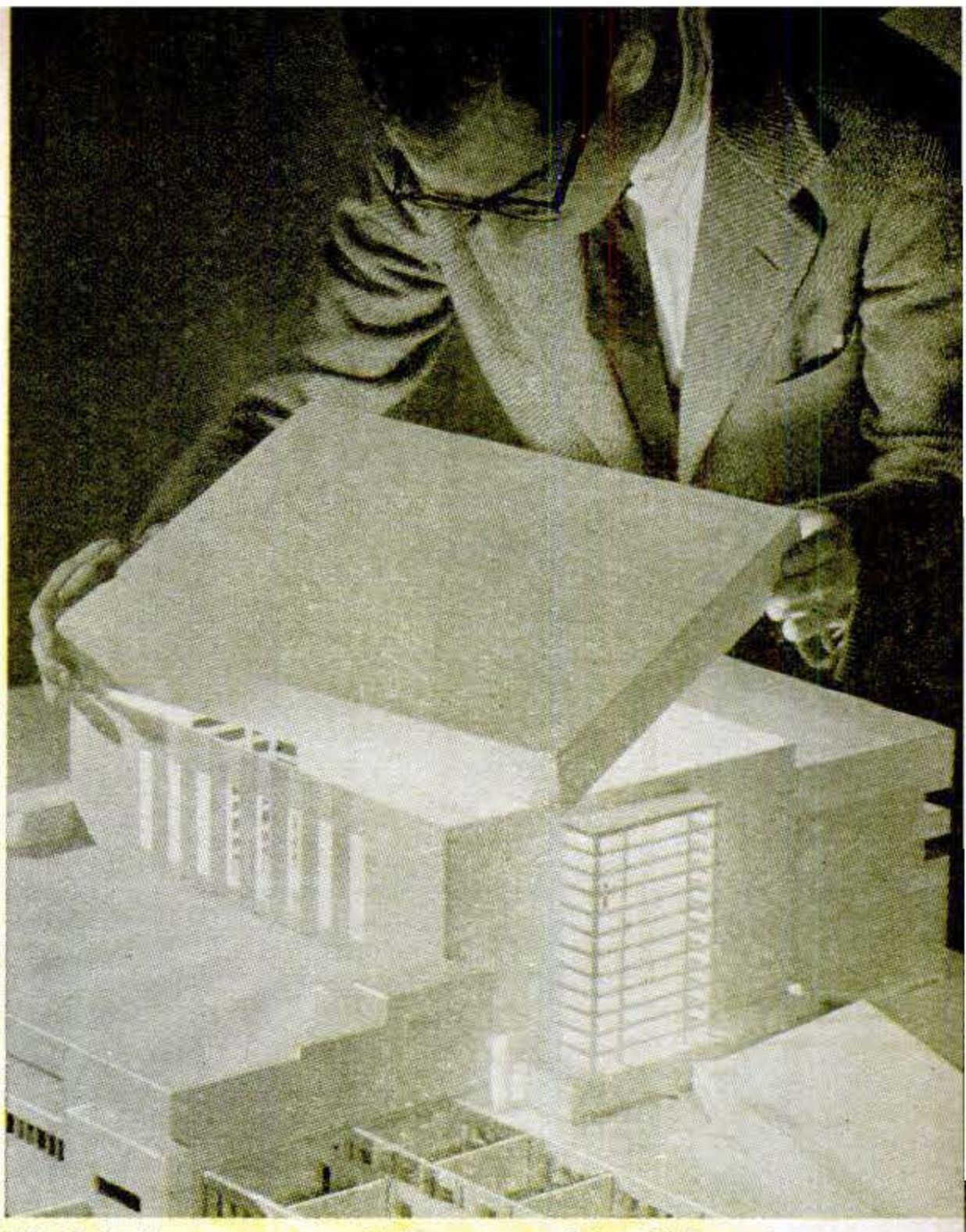
Popular Science shows you the innards of Brookhaven's nuclear furnace.

U.S. Lights New Atomic Pile for Peace



Model shows unusual features of building that houses uranium pile now nearing completion at imposing research laboratory on Long Island.

By Martin Mann

SOMETIME this summer a young man in a sports jacket will twist a few knobs with his eyes fixed on a Geiger counter, then turn and say, "It's critical." The atomic pile at Brookhaven National Laboratory then will be running under its own "steam."

This, the fourteenth furnace ever built to release and control the terrifying forces in the heart of the atom, will be the world's most powerful air-cooled pile. Only the water-cooled giants that manufacture plutonium for bombs at Hanford, Wash., outrange it in the U. S. Brookhaven's pile, however, will not make fuel for bombs, and may not produce any usable power. Instead, it will produce more wrinkles in men's brows —by increasing their knowledge.

Drive out Long Island's Jericho Turnpike 65 miles from New York City to the edge of the duck- and potato-farm country, then turn off at an inconspicuous sign marked "Brookhaven National Laboratory," and you will quickly spot a big, striped smokestack. It towers above a group of modest frame and concrete-block buildings that house the laboratory. The smokestack and the most imposing buildings are on the side of Rutherford Hill—named for Sir Ernest Rutherford, the British physicist who laid the foundations of nuclear theory.

The biggest building, a light brick structure six stories tall, with two gigantic, green-glassed bay windows, contains the pile. It has two lower wings for laboratories especially designed and equipped for workers with radioactive chemicals. And there is a detached building in the rear for the "hottest" laboratory, where experiments with intensely radioactive substances can be conducted by remote control. Nearby are the fan house, cooling towers, and stack.

No smoke will ever belch from the stack

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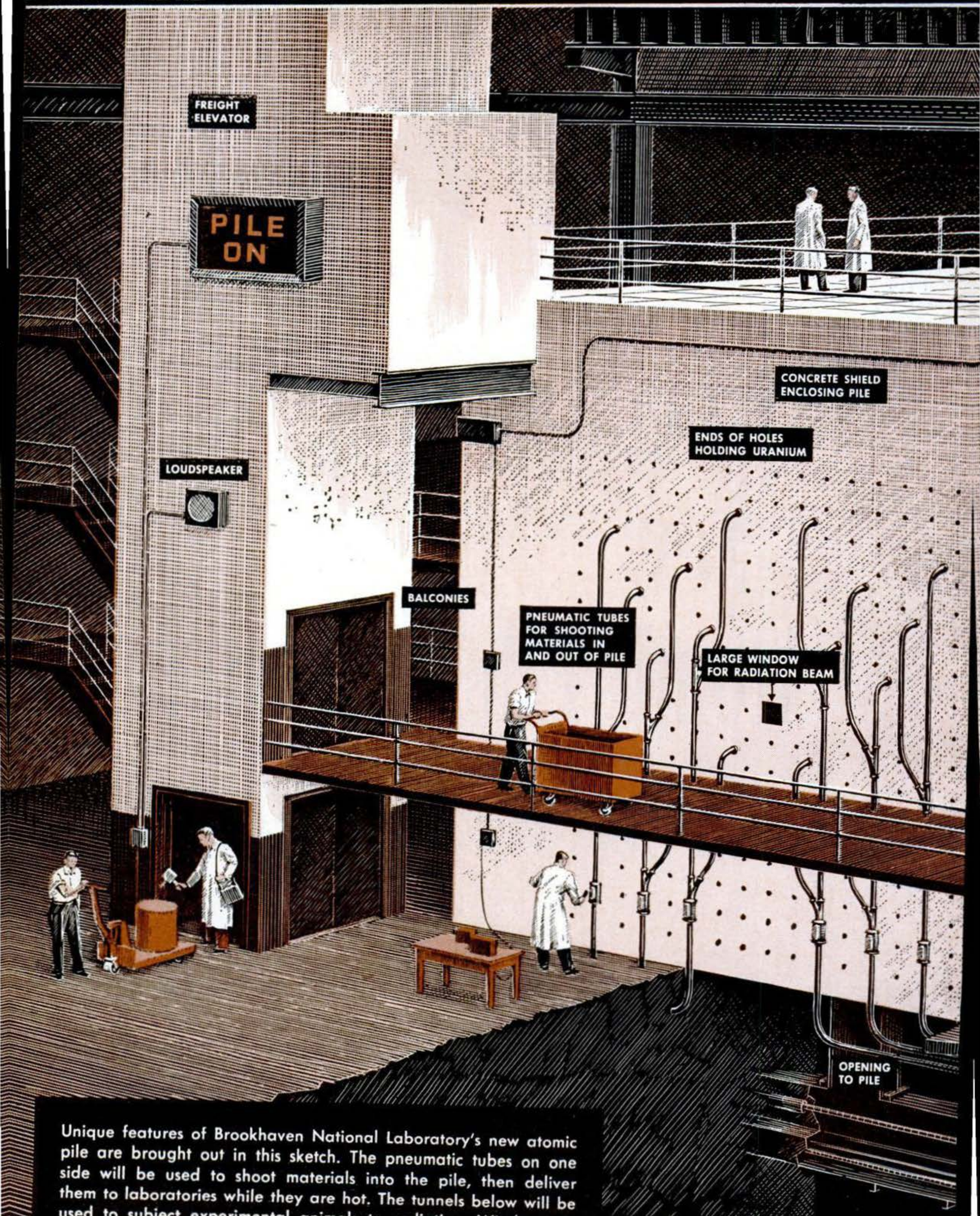

Unique features of Brookhaven National Laboratory's new atomic pile are brought out in this sketch. The pneumatic tubes on one side will be used to shoot materials into the pile, then deliver them to laboratories while they are hot. The tunnels below will be used to subject experimental animals to radiation. Windows on other sides will let invisible beams shoot out for other experiments.

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CRANE HANDLES HEAVY EQUIPMENT

PILE LOADED AND UNLOADED FROM BACK

CONTROL ROOM

PILE ON

TOP SHIELD MADE OF REMOVABLE BLOCKS.

WINDOWS LET RADIATION OUT OF PILE

DANGER

DANGER

LEAD BRICKS SHIELD OPEN WINDOWS

INSTRUMENT TUNNEL

SOME PNEUMATIC TUBES GO DIRECTLY TO NEARBY LABORATORIES

TROLLEY CAR

TUNNEL THAT SENDS ANIMALS UNDER PILE

INTAKE PIPE FOR COOLING AIR

Ray Proch

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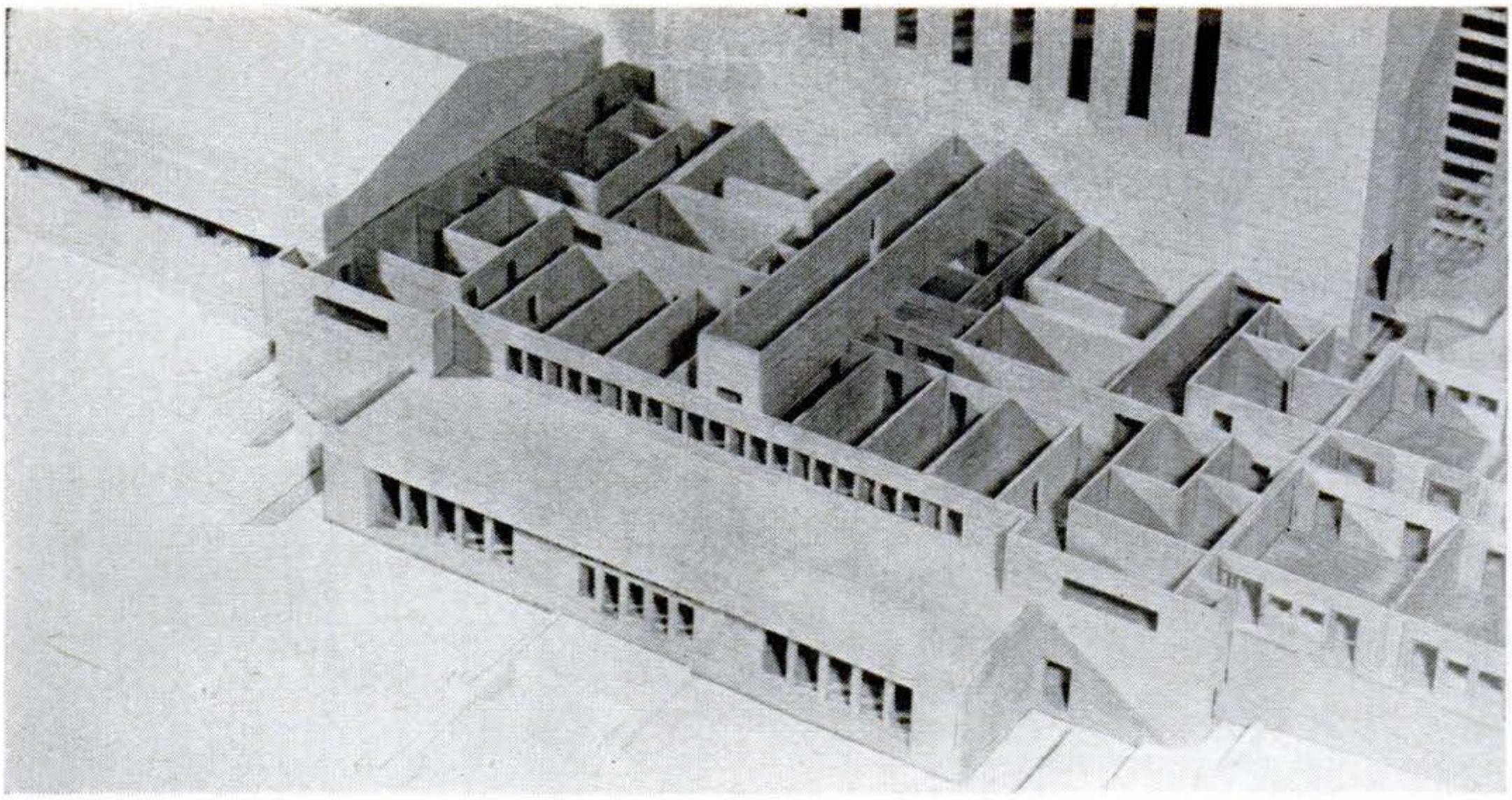
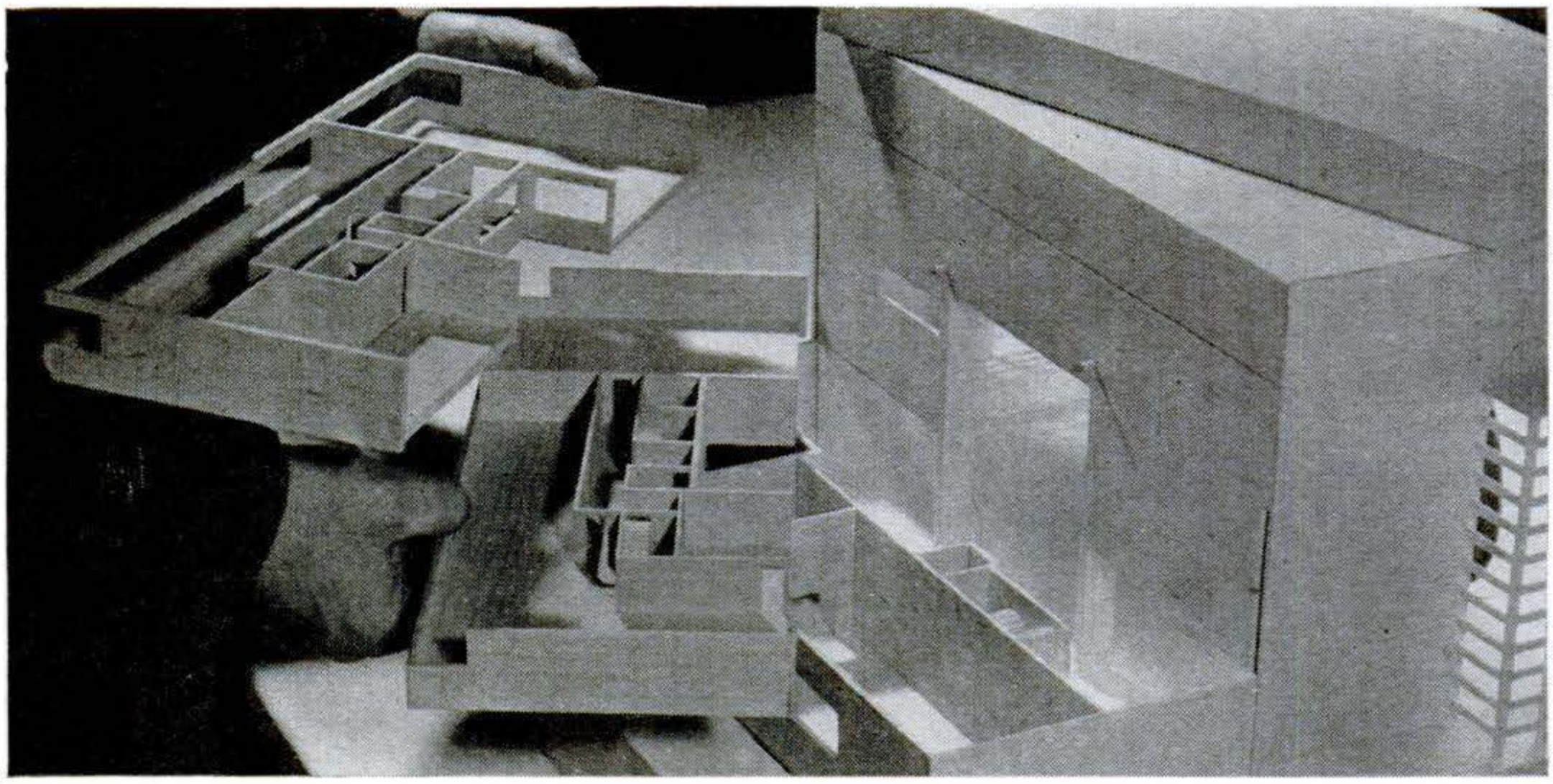


Scale model of the pile building has removable sections to show details of layout. Corridor that provides path for 60-ft. neutron beam can be seen in center. Layout of halls gives two routes to each laboratory (in right and left wings) in case one path is blocked by an accident.



Back view of the model shows section where the uranium metal will be handled. Shop for machining it and vault for storing it are on lower floor, other shops and offices above. Large door to pile room provides access to entire "lattice"—the openings that hold the uranium rods.

of this plant (PS, Nov. '48, p. 108). Instead it will release the cooling air that gigantic fans will whirl through the pile at a rate of many tons a minute. And this radioactive air will come out of the stack only when atmospheric conditions are such that it will be safely dispersed.

To go inside and see the pile itself, you need a "Q" clearance from the Atomic Energy Commission. The drawing on pages 122 and 123, however, shows you even more than would meet your eye if you walked into the huge room containing the beige-painted concrete cube, about 40 feet on a side. Only three faces and the top are exposed. The back—not visible in the drawing—is where the uranium is put in. Because this pile "burns" so fast, a new charge will be needed at least every few years.

The three visible sides bristle with balconies, tubes, rods, switchboxes, and wiring. On the two parallel working faces are seven rows of small windows. Most of these are about four inches square. These windows

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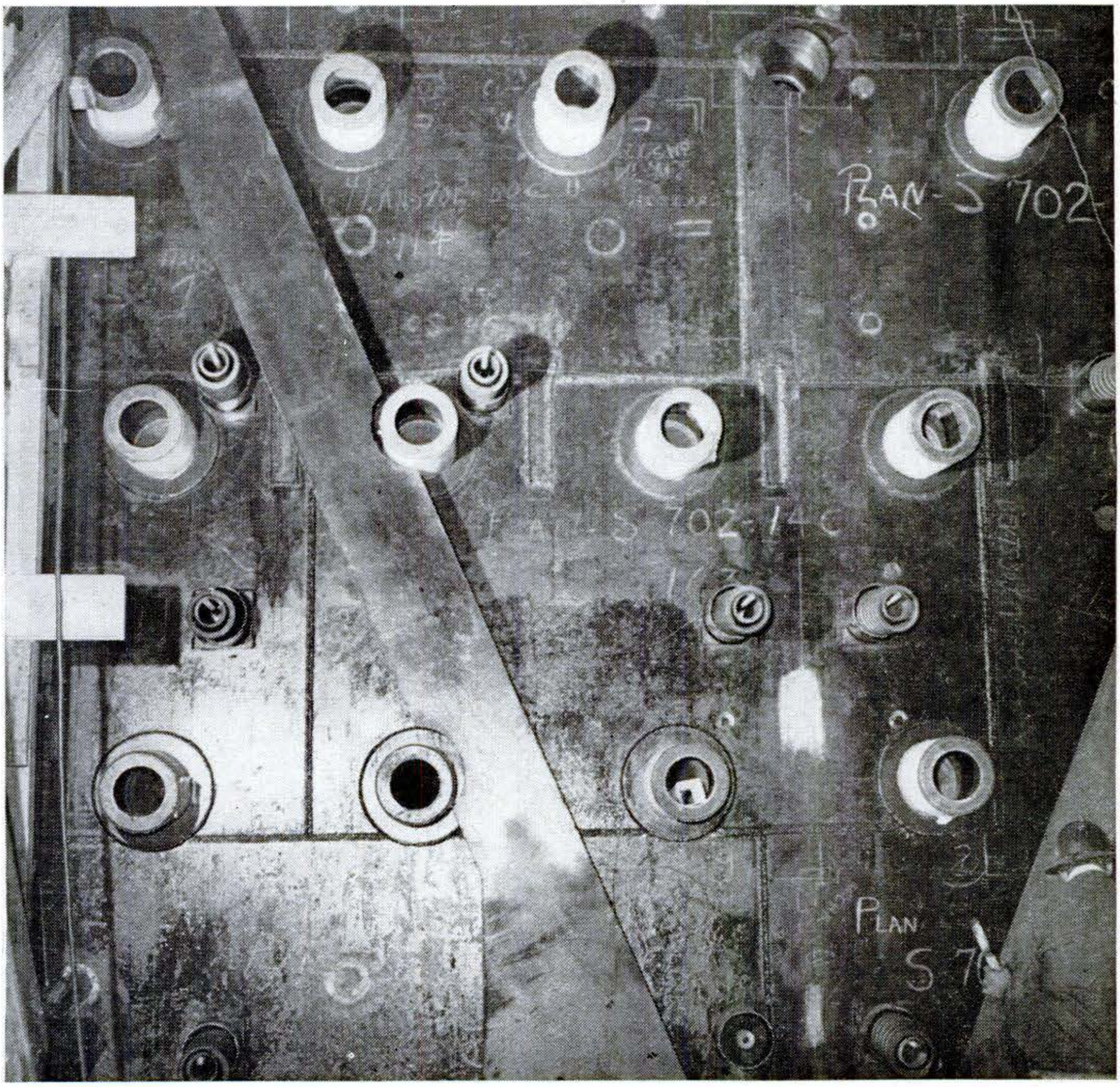
go directly into the hot heart of the pile. Material can be inserted through them for irradiation inside the pile. And beams of neutrons, gamma rays, and all the other kinds of particles and waves can be let out of the pile through them. The windows extend all the way through to both faces, in case something placed inside has to be pushed out. Balconies sticking out from the faces of the pile give easy access to the upper rows of windows.

The north face of the pile (directly in front of you in the drawing) has a system of pneumatic tubes that reach into its center. These tubes are like those used in department stores to relay orders and make change. Here they will be used to shoot material into the pile to be bombarded with neutrons, and to whisk back the newly made isotopes. This arrangement permits study of short-lived isotopes, the ones that lose their radioactivity and change into something else in a few minutes or even seconds.

Some of the pneumatic tubes end at the pile face itself; others extend under the floor into nearby laboratories, so that the isotopes can be delivered straight to a scientist's workbench. It is even possible to connect the tubes directly to experimental equipment, so that a fresh radioisotope will pop right into a test tube or flask and immediately become part of an experiment.

On the same face of the pile you can also see the lattice—the ends of the openings that hold the uranium rods. These



Atom's-eye view of the pile from inside of it. This photo, made during construction, shows inside of one face with openings that let materials in, radiation out. Note workman at right.

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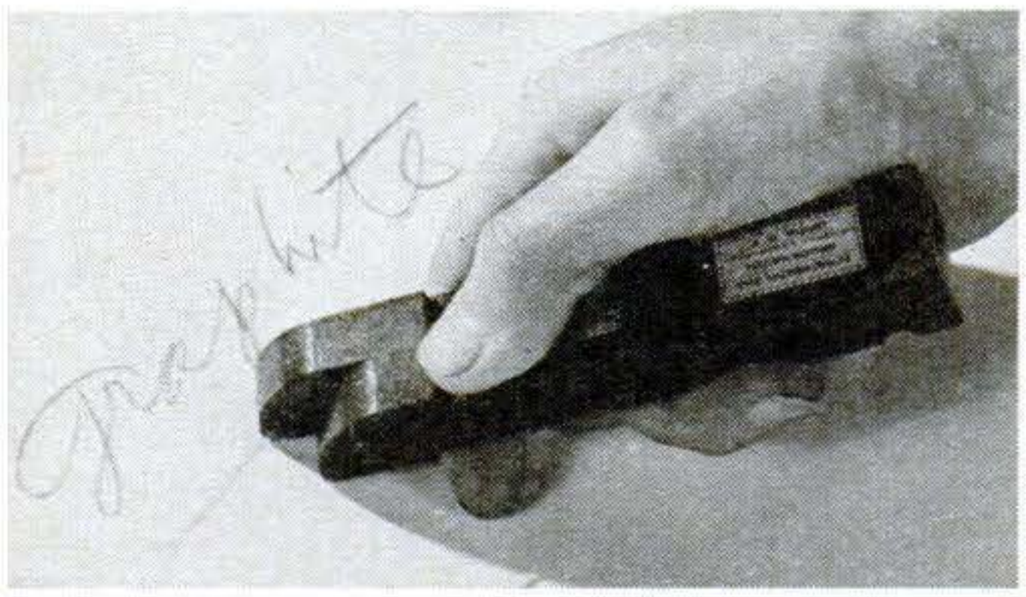
openings extend through the pile. The actual loading and unloading, however, always will be done from the opposite side.

One other opening in the south face is a large one, about a foot square, set in the very center. It allows a beam of neutrons to shoot out of the pile and down a corridor built for it through the adjacent laboratories and offices. Such a beam, 60 feet long, may help experimenters determine the extent to which distance affects the ability of various materials to absorb neutrons.



Most of the pile is graphite, like lead in pencil. You can actually write with it. Above is model of one of more than 60,000 graphite bricks used.

When the pile is cut off, scientists may also work on top of it. The top is made up of 4-ft. square concrete blocks that can be lifted out to make openings wherever the researchers want them. These large openings do not give access to the center of the pile, but merely expose its outer graphite shell. A lot of slow-moving neutrons leak through the shell (this "leakage flux" is about 1/50 as intense as the neutron beams from the heart of the pile) and can be used for experiments in big apparatus placed over the opening in the shield.

Tunnels for Tests with Animals

As a visitor to the pile room, you might also notice trapdoors in the floor. They lead to two tunnels that pass directly underneath the pile. In each tunnel there is a small car, pulled by motor-driven chains, that can be moved back and forth through the tunnel and stopped under an opening in the pile's bottom shield. The smaller car is for exposing instruments to the full blast of radiation from the pile. The larger one can carry animals as big as chimpanzees.

Animal experiments may reveal a cure for radiation sickness—whether caused by an accident or a bomb—and may also tell much about cancer, heredity, and the other biological mysteries. This is the first installation permitting studies with animals of near-human size and complexity. Previous work at Oak Ridge has been limited mainly to rats and rabbits.

Inside the concrete cube there are 60,000 pieces of graphite, which resembles the lead in your pencil but is nearly 100 percent pure. There are 2,600 different sizes and shapes of these pieces. Putting them together was like assembling a colossal Chinese puzzle. These thousands of "bricks" were made so accurately that they fit together to form an almost airtight mass without needing cement or mortar between their joints.

Inside this graphite block, within the concrete cube, is a maze of channels. Aluminum cans containing the long rods of uranium that make the pile powerful fit into some of them. Others are for the cadmium rods, which the operators can slide in and out like pistons to regulate the rapidity with which the invisible neutrons split the invisible atoms of uranium. Still others are the ducts through which the air to cool the pile circulates.

Fuel Is a Mixture of Isotopes

The uranium in the Brookhaven pile is "natural" material. It is highly purified, but is still a mixture of the three isotopes—U-234, U-235, and U-238. Only the U-235 atoms fission (split), and they are barely 0.7 percent of the total.

Nevertheless, the Brookhaven pile will run at fairly high power—unofficially estimated at about 5,000 kilowatts or more. Most of this power will be wasted, but about 1,500 kilowatts could be converted into electricity to help run the cooling fans. (Outside power would still be needed for the fans, however, since they draw much more than 1,500 kilowatts.) If this is done, the Brookhaven pile will become the first in America to generate useful electric power.

But the new pile will not produce anything like 5,000 kilowatts immediately. At first its power output will be nearer zero. For it will be "warmed up" slowly and will not be operated at full power until, possibly, sometime in July. This slow rise in output will give the engineers a rare opportunity to learn things that cannot be learned after a pile has its full load of fuel. During this build-up period, scientists will study the pile closely, watching the neutron production in various sections, the changes in the

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graphite bricks, the effects of weather conditions, the way the control changes with increasing power, and how fission products build up in various parts of the pile.

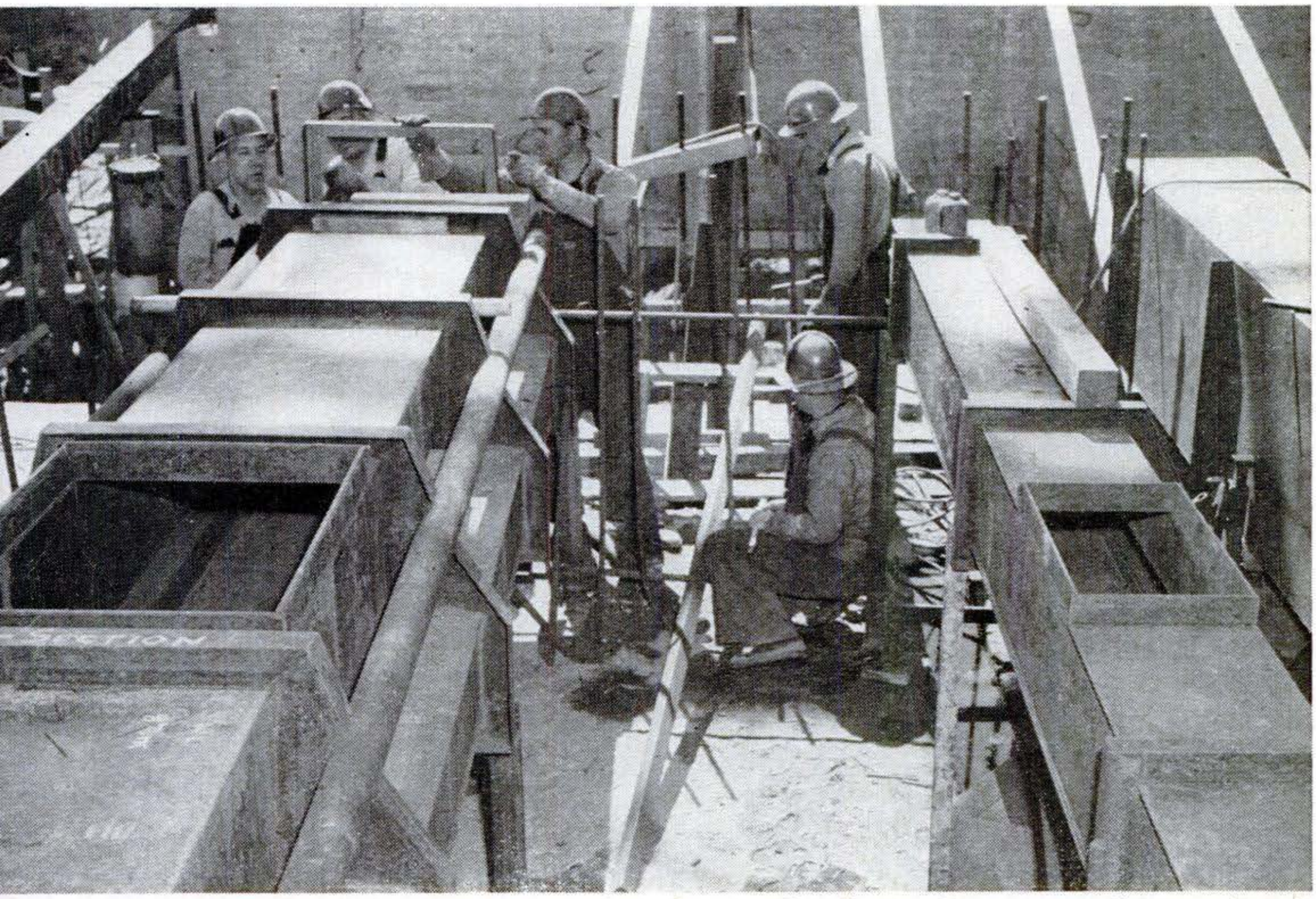
By next fall the research program for which the pile is being built should be running full blast. It will cover nearly every field of science—physics, chemistry, biology, medicine, and all the rest. But much of it will be concentrated on chemical and metallurgical problems related to materials used in piles. For materials are the main stumbling block to atomic progress now. If the engineers had the right materials, they could design good nuclear engines for power plants, rockets, airplanes, or warships in a jiffy.

Will Gold Shield Atomic Engines?

Shielding is one of the toughest problems. The shield on the Brookhaven pile—the part you can see—is made of a special, secret kind of concrete at least six feet thick. You can't put that heavy a shield in an atomic rocket, or even a battleship. But what can you use that's lighter? Professor Walter G. Whitman, head of the chemical engineering department at M.I.T., recently made a study of light shielding materials for the Atomic Energy Commission. His report: the cheapest shield now available would be *24-karat gold!*

Another big problem is finding structural materials to use inside an atomic engine. Most ordinary things either react badly with neutrons or melt under the high temperatures. Steel absorbs neutrons so fast that it would stop a pile completely. For a while, the unusual metal titanium (now used in white paint) looked like a good bet, but it has not lived up to expectations. Zirconium might work, but it is always accompanied by hafnium, which is bad. Rubidium and caesium, two other possibilities, are too scarce.

Then there is the ash headache. When a U-235 atom fissions, it breaks into two pieces—two new elements each weighing somewhere around half as much as uranium. (These fission products are not always the same elements, but may be any of the 24 that range from selenium to lanthanum in the periodic table.) The fission products will not fission themselves. Worse than



Tunnels for cars that will carry animals and instruments under the pile were set in the massive foundation. Openings in the tunnels will expose the cars and their contents to radiation.

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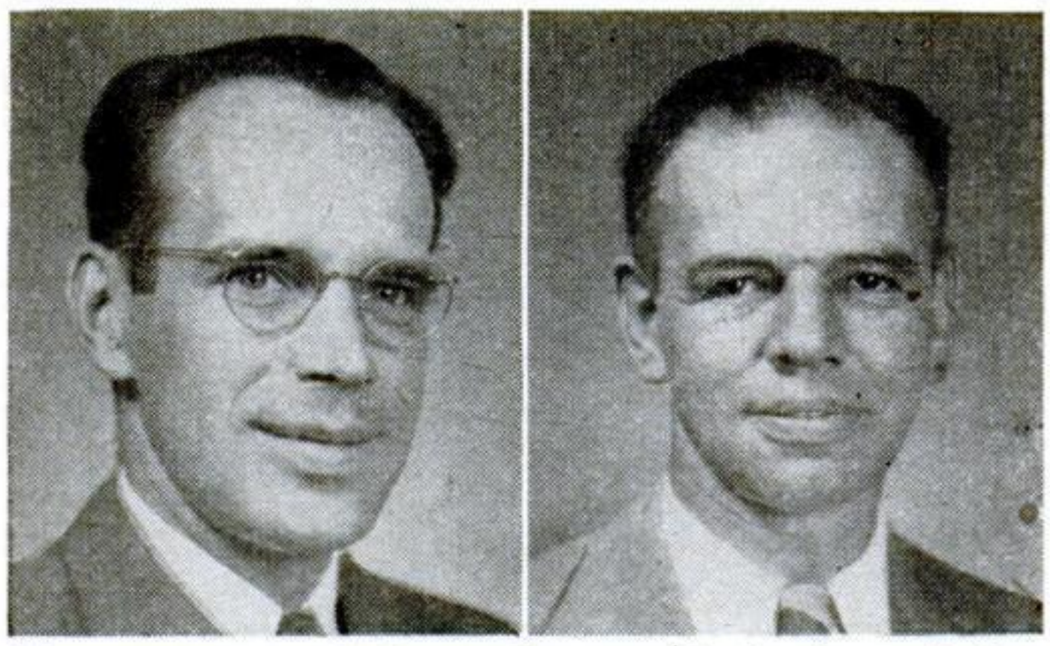
that, they absorb neutrons, reducing the power of the pile. Nucleonics experts call this process "poisoning the pile."

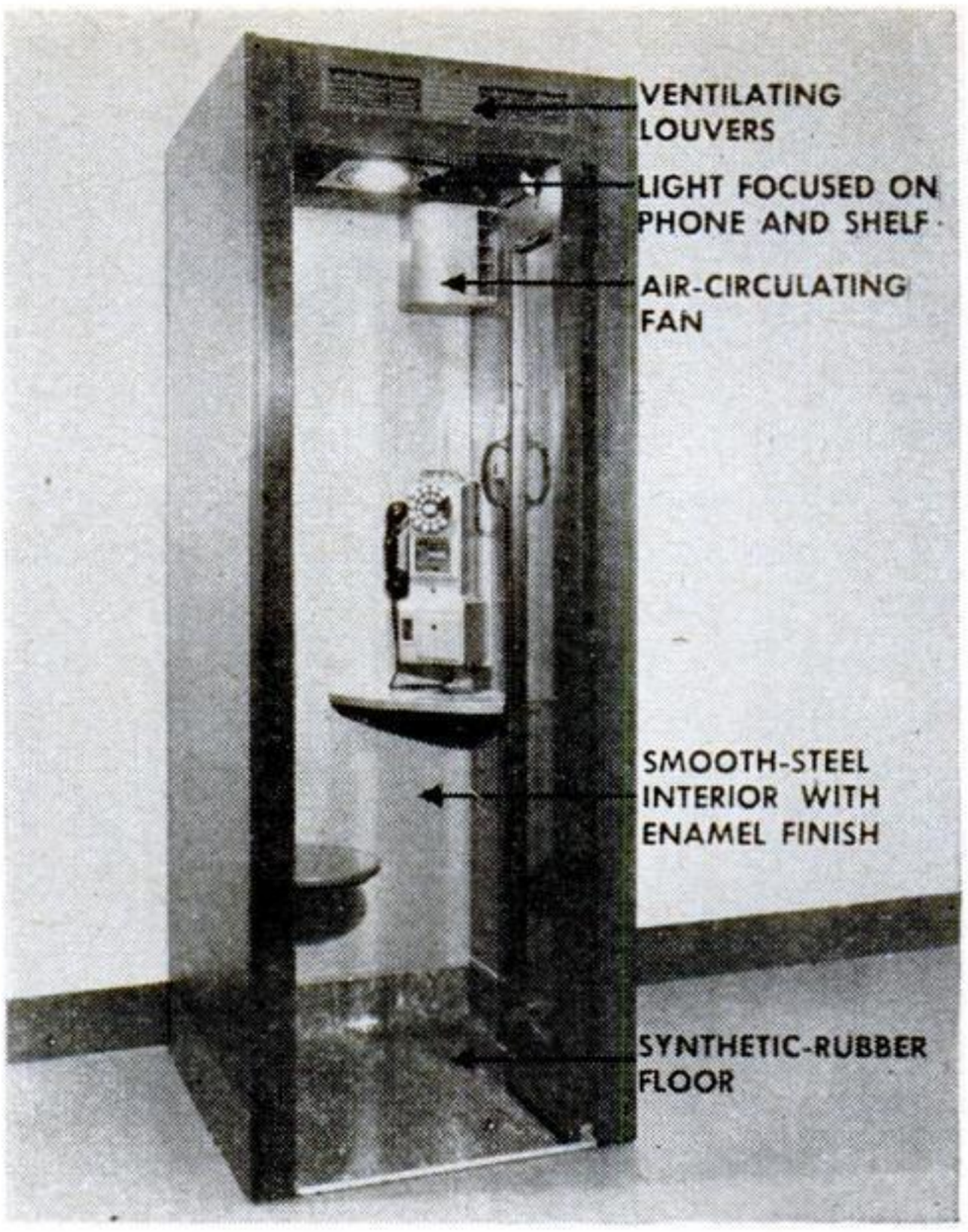
The poisons, or nuclear ashes, have to be taken out after the pile has operated a while. But mixed in with the ashes is a lot of good, fissionable uranium far too valuable to throw away. As Sumner Pike, one of the members of the AEC, once said, a pile is like an inefficient coal furnace that lets unburned coal fall into the ash pit. You can shake the ashes, get that coal out, and put it back in the furnace. But the nuclear "ashes" must be shaken at least 10 times to get all the uranium out. These ashes also contain plutonium, the fissionable stuff in bombs, and other materials so radioactive that you dare not get too close to them even if you wear an asbestos suit.



These men will lead the search for knowledge made possible by the pile. Dr. Lyle B. Borst (left) heads the pile project, and Dr. Leland J. Haworth (right) is director of Brookhaven.

So ways must be found to reduce the poisoning effect of the fission products, so that the ashes won't have to be shaken so many times. More efficient and cheaper methods of doing the shaking must be learned, too. Present estimates indicate that a plant for shaking an atomic ash barrel would cost as much as the atomic power plant it would accompany. And somebody has to figure out an easy way to get rid of the left-over radioactive "garbage," now mostly buried in huge underground tanks.

The Brookhaven experimenters may not answer these questions—or even attack them directly. Brookhaven's scientists merely seek facts, any kind of facts, not just those dealing with power plants and rocket motors. Yet the basic facts of nature are the bricks out of which some men, somewhere, sometime, *will* build power plants and rocket motors. END



Meet the New Phone Booth

HERE's the phone booth you will be seeing soon in your corner drugstore. Designed by Bell Telephone Laboratories, it has a ventilating system that changes the air several times a minute. An improved lamp concentrates four times as much light on the instrument and writing shelf. The interior is finished in a beige "hammer effect" that masks scratches.

Leak Sniffer Tests Footballs

THIS picture shows a sensitive laboratory instrument hard at work in a new job: checking footballs for leaks. GE developed the electronic gas detector (PS, June '48, p. 113) to test airtight apparatus. Now the Collette Mfg. Co. uses it on footballs by inflating them with Freon®. If any leaks, the detector sniffs it in air sucked into the probe.

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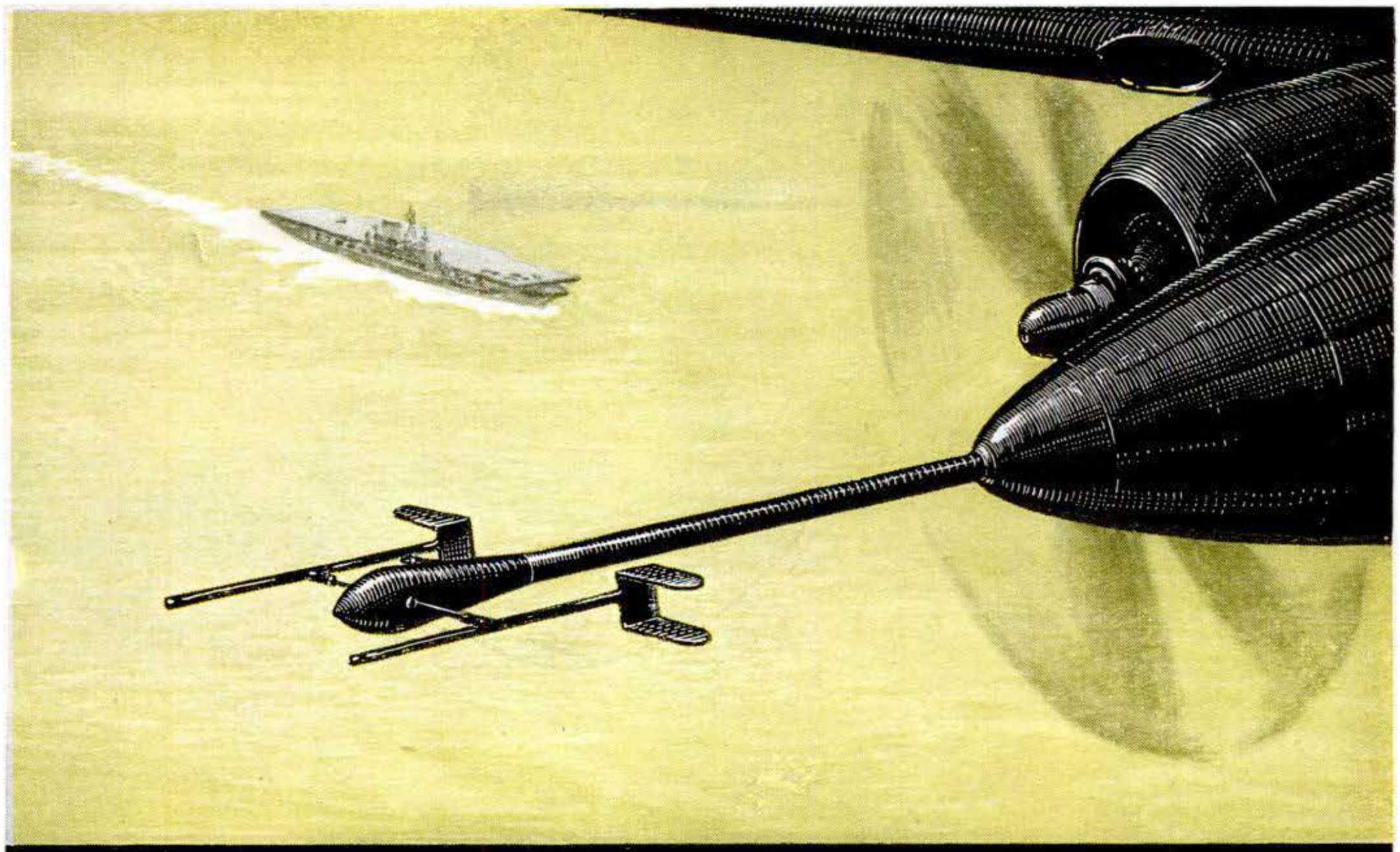

Vanes sticking out from the nose of this Navy fighter are feelers that will prevent stalling and permit slower approaches. The device may make possible robot landings on carriers.

Extra Sense Added To Navy Autopilot

By Herbert Johansen
Drawings by Ray Pioch

THE colorfully garbed landing-signal officers aboard our aircraft carriers may soon be out of a job.

When that happens, a pilot coming in for a landing need only drop his wheels, flaps, and hook—then sit back with his hands folded. The landing-signal officer's job will have been taken over by a man deep inside the ship. Sitting in front of radar and television screens, he will beam orders to a robot pilot in the approaching plane. The pressing of buttons and the flipping of switches will bring the plane down on the deck for a perfect landing with greater ease and safety than any pilot could—and in any weather.

For something new has been added to the automatic pilot to make possible letdowns of such uncanny accuracy. It is a supersensitive feeler, still experimental but already successfully tested, resembling a weather vane in appearance and operation. Sticking out from a plane's nose or wing, it is sensitive to the aircraft's *angle of attack*.

This is the angle between a line drawn through the chord of the wing and the plane's line of flight.

That angle is *not* determined by the *attitude* of the plane. The longitudinal axis of an aircraft may be parallel to the earth, for instance, while actually the plane is slipping downward as well as flying forward. The angle of attack in this case would be the angle between a line projected through the wing and the direction of airflow caused by the plane's combined downward and forward flight.

When this angle increases beyond a certain critical degree, the flow of air over the wing is disturbed. The result is a loss of lift so great that the plane stalls. A stall is especially dangerous during a landing approach, in which a plane may lose altitude so rapidly

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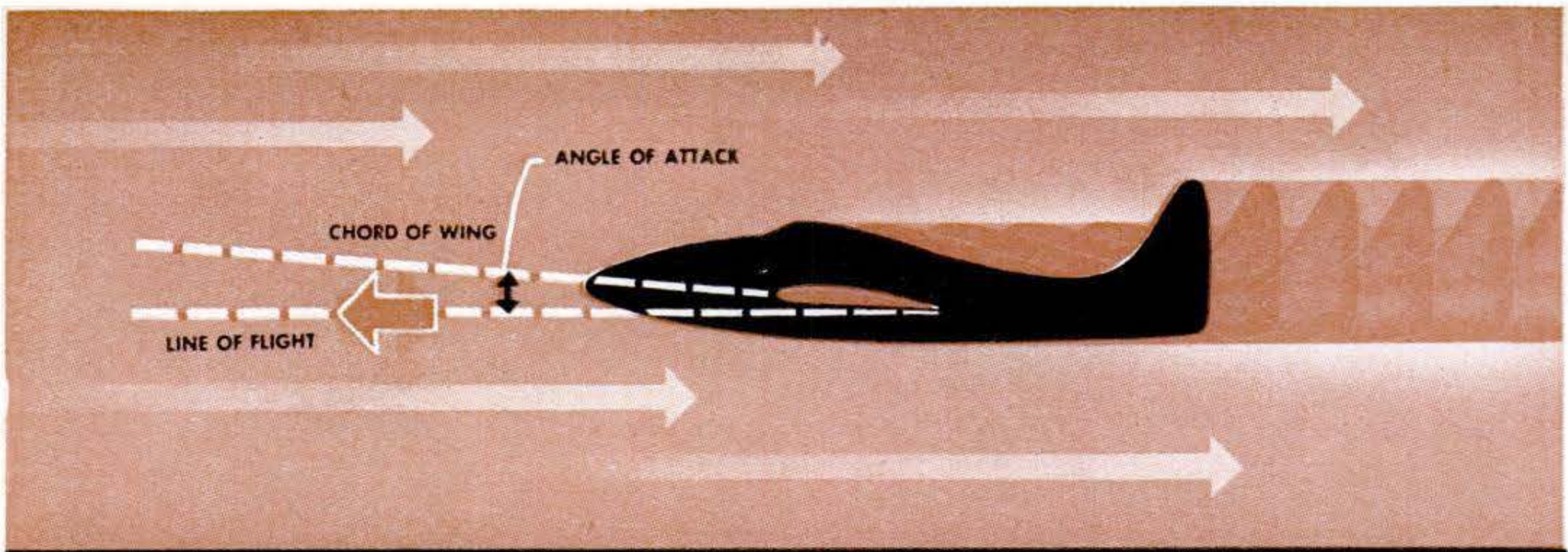
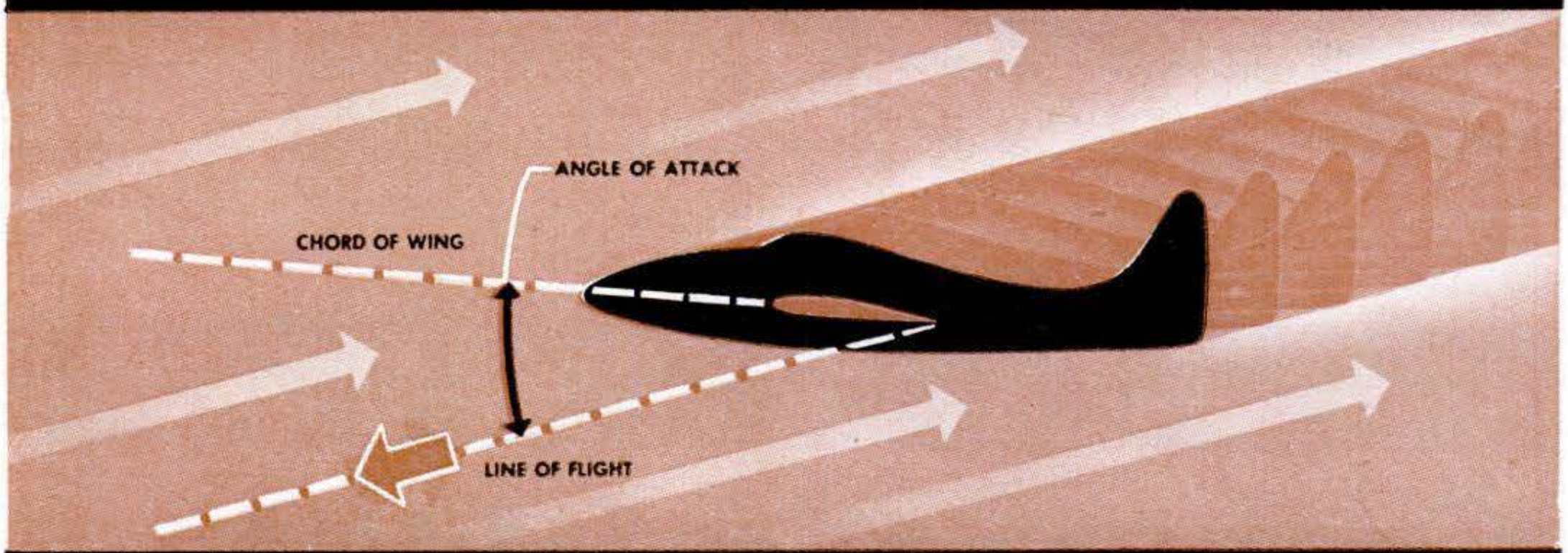


Angle of attack, as shown here, is formed by a line drawn through the chord of the wing and the direction of air flow (light arrows) caused by the plane's line of flight.



Here the plane, still headed in a horizontal direction, is actually moving down, as shown by upward direction of air stream. Note that the angle of attack has greatly increased.

that it cannot recover. The result is a crash.

A plane's angle of attack is increased to the stall point by too heavy a wing load in relation to airspeed. Thus the stalling speed of a plane varies, depending on how heavily it is loaded. But *the angle of attack at which any particular plane will stall is always the same.*

Unfortunately, a pilot's judgment of angle of attack is very poor. He must therefore depend on airspeed to prevent a stall. To do this accurately requires data that are not always available in flight (such as reduced weight due to fuel consumption) and takes quite a lot of figuring. The result is that the pilot maintains enough speed to keep his angle of attack well on the safe side of the stalling point. This means, among other things, that he usually lands at greater speed than is really necessary—and a high-speed landing can be dangerous.

Now comes the Navy's new gimmick. It continuously and accurately measures the angle of attack and, by controlling the power delivered by the engines, can automatically keep the plane flying at just above the stalling point for whatever load it happens to be carrying.

You can see how this would help in landing a plane on the short flight deck of a carrier. For, with the angle-of-attack device, a plane can get to the very edge of the stalling point without any danger of stalling. By landing at a slower speed than the pilot would dare risk by just guessing, it hits the deck with less impact and needs less runway.

The new autopilot has been installed experimentally on an R4D (Navy version of the commercial DC-3). This plane ordinarily makes landing approaches at a minimum of 90 miles an hour. With the new angle-of-attack device, it can be brought in safely at between 70 and 75 miles an hour. With high-speed planes, the advantage would be much greater.

But the new device does much more for a plane than just keeping landing speed at the minimum. By manipulating other controls, as well as regulating engine power, it

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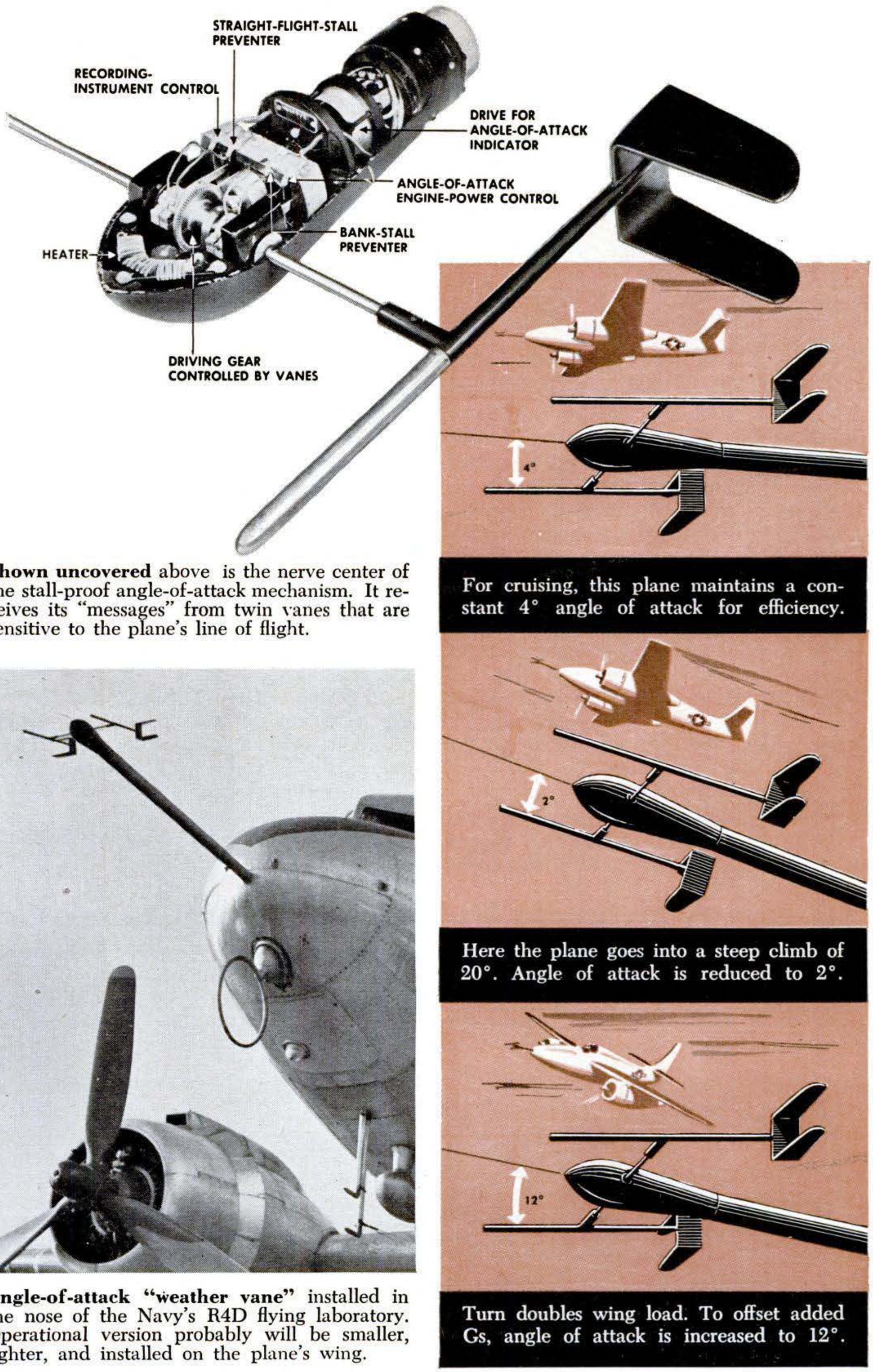

Shown uncovered above is the nerve center of the stall-proof angle-of-attack mechanism. It receives its "messages" from twin vanes that are sensitive to the plane's line of flight.

For cruising, this plane maintains a constant 4° angle of attack for efficiency.

Here the plane goes into a steep climb of 20°. Angle of attack is reduced to 2°.

Turn doubles wing load. To offset added Gs, angle of attack is increased to 12°.

Angle-of-attack "weather vane" installed in the nose of the Navy's R4D flying laboratory. Operational version probably will be smaller, lighter, and installed on the plane's wing.

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prevents stalling in any condition of flight.

Built into it are limiters, or stall preventers, set at a specified maximum angle of attack. Suppose that this safety limit for a particular plane is 18 degrees. If the plane approaches that stall point in a climb, and is already using full power, the limiter will send a signal to the autopilot's servo motors for elevators down. And the plane's nose will be lowered enough to keep the angle of attack within the set limit. If the plane approaches a stall in a turn, the limiter automatically nudges the aileron controls to reduce the bank angle and maintain a safe angle of attack.

Helps Plane Perform at Its Best

The new control mechanism also makes use of the fact that every plane has a most-efficient angle of attack for every maneuver. A chart will show a pilot his ship's optimum angle of attack for climb, glide, turn, and level flight. And the feeler, by showing him its actual angle of attack at any moment, will enable him to keep it performing at its best.

For cruising, angle-of-attack flying actually saves enough fuel to add miles to the range of a plane. Accurate control of the angle of attack to prevent stalling will enable jet fighters to hold the high ceilings at which they perform most efficiently. In combat the fellow who can stay at 38,000 feet while his enemy drops to 35,000 will have a great advantage.

As a pilot-safety factor, the new automatic equipment can be adjusted to prevent a plane from going into violent maneuvers that would subject a man to G forces beyond human tolerance.

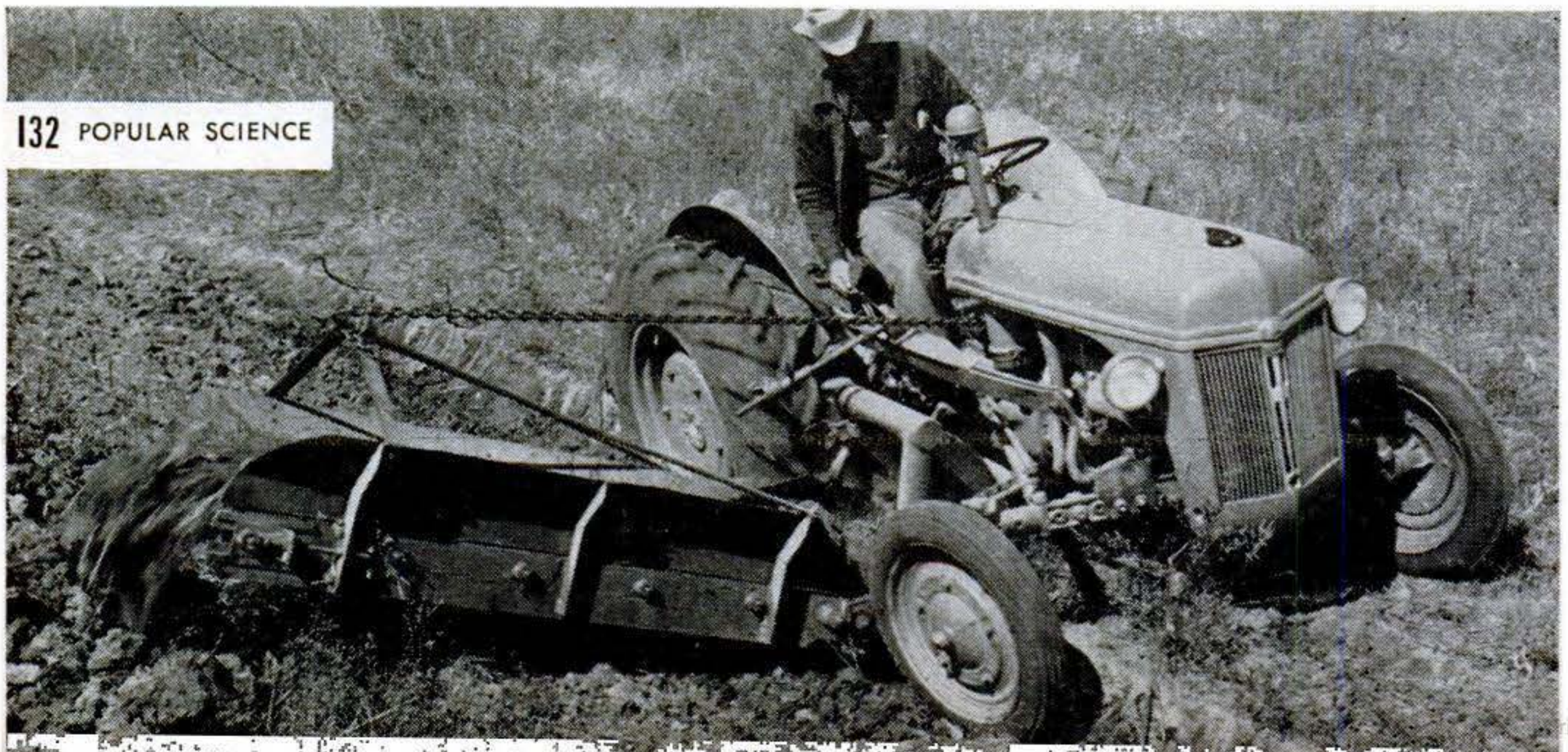
Angle-of-attack flying may even change the design of planes, permitting stubbier wings that would have too low a stalling point for safety under manual control. True, this might lessen the plane's maneuverability. But the day of dogfighting tactics is long gone. In another war, fighter planes probably will not even carry guns to shoot at other fighter planes. As supersonic extension platforms for launching guided and other missiles at bombers, they would not need great maneuverability.

Installation of the stall-proof robot pilot on the Navy's fastest jet fighters, as well as on Navy planes of all types, is more than a possibility in the near future. At the Navy's Special Devices Center on Long Island, however, the project officer, Commander Edward F. Saxman, Jr., confined his comments to the experimental installation on an R4D flying laboratory. This equipment was developed by the Minneapolis-Honeywell Co., which is now working out improvements and ironing out bugs under Navy supervision. One job is to reduce its present weight of 140 pounds to an operational weight of about 60 pounds.

Development of robot equipment of this type indicates that the day of strictly hands-off flight may not be far away. When it comes, the pilot's job will be confined to controlling prop pitch and fuel mixture, plus putting down flaps and wheels on take-off and landing. And even those chores may be taken over by electronic fingers.

Tractor Attachment Builds Terraces the Easy Way

A ONE-MAN weapon against soil erosion, the earth-moving device, attached to the tractor below can throw up a mile of terrace in a day. As the tractor moves, a plow cuts a trench 10 inches wide and 10 inches deep, throwing the loose dirt onto an endless belt. The belt, driven by the tractor engine, deposits the dirt in a ridge up to six feet away. The terracer was invented by William H. Tucker, a Marion, Kans., rancher.



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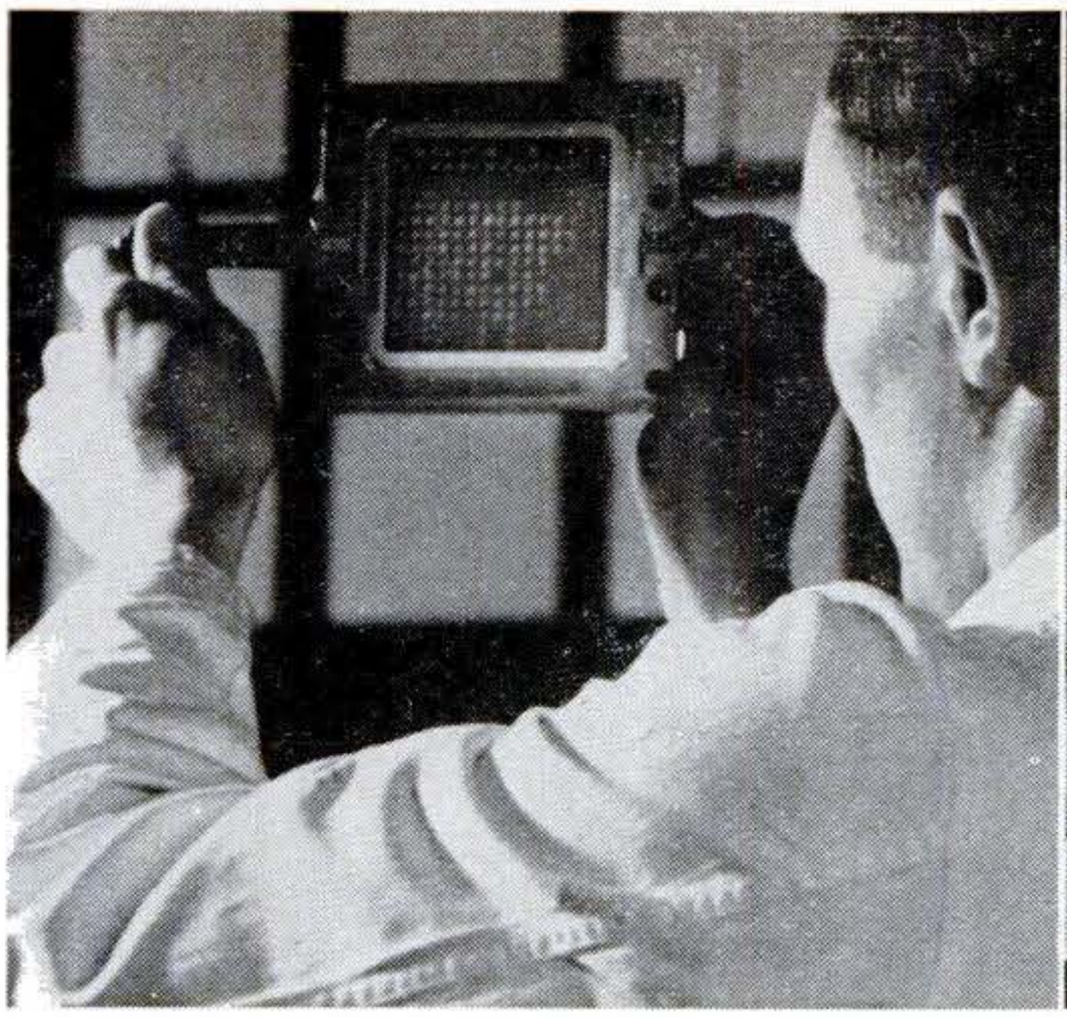
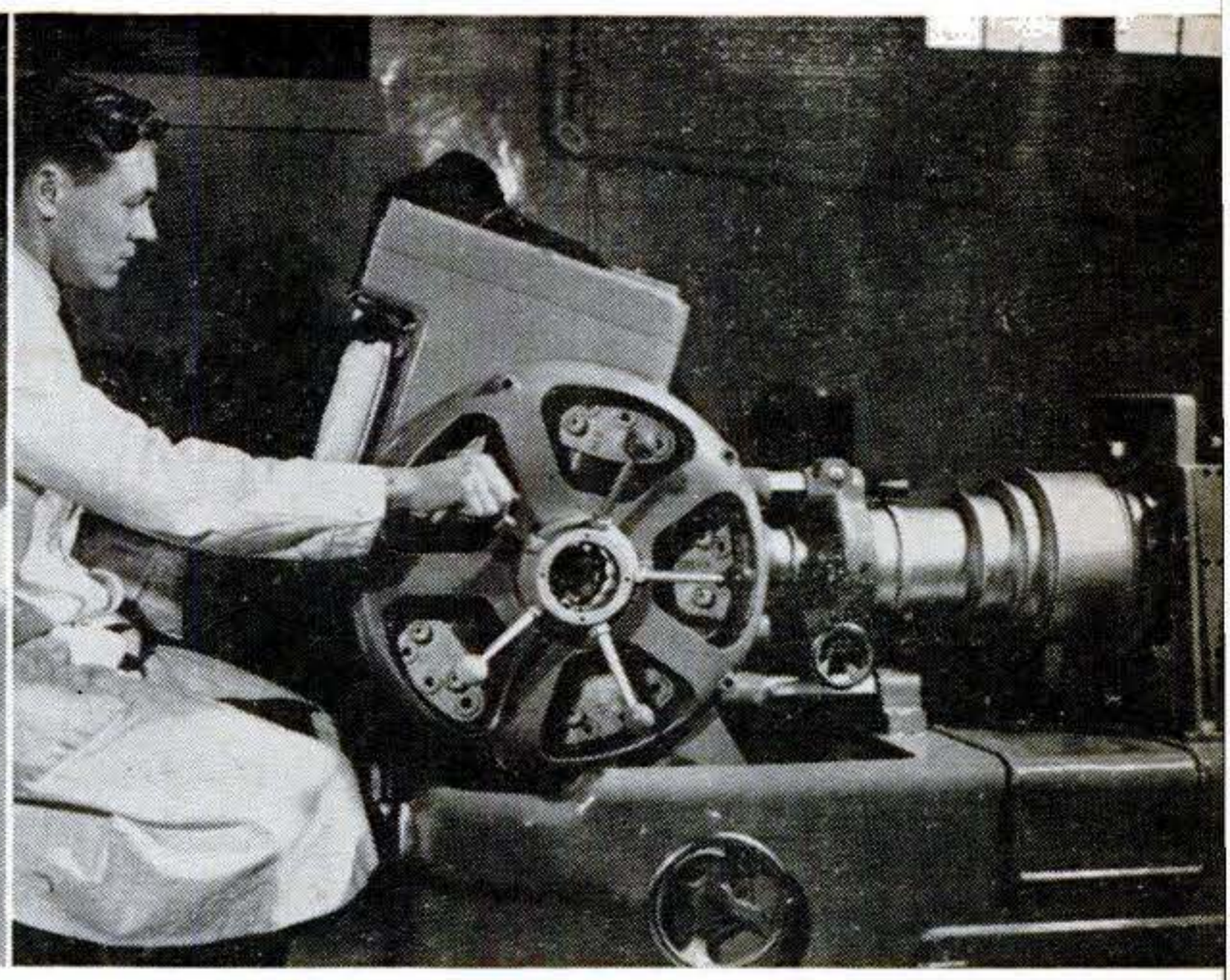




Type Set Photographically in New Printing Process

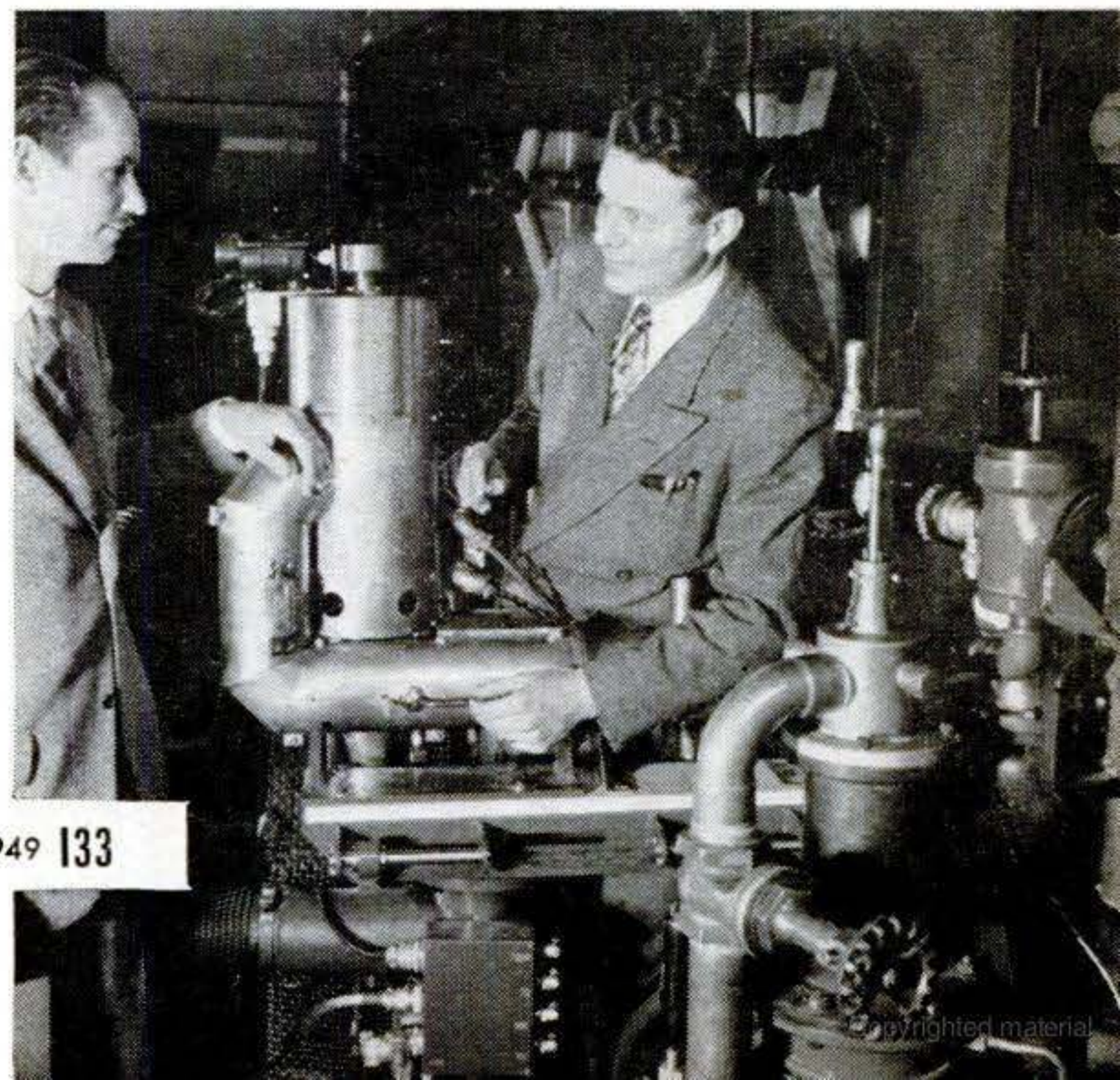
TYPSETTING without type is made possible by a new British process called Rotofoto®. It's all done with pictures—photos of each letter. Text is first tapped out on the keyboard of a tape puncher. The tape directs the selection of individual letters from a master negative (above) carrying photographic images of all letters in a type family. The text is then projected letter by letter in sequence on a 35-mm. film. A page-composing photoprinter (right) then combines the text image with those from four other films carrying headlines, subheadings, and corrected lines. Result: a transparency from which an ordinary rotogravure copper printing cylinder is etched.

Hot Rings Test Motor Oil

RADIOACTIVE piston rings are helping to develop better lubricants for motorists. Irradiating a ring for a month in the Oak Ridge, Tenn., atomic pile turns part of its metal into ray-emitting iron 59. Handled gingerly, as below, the "hot" ring is inserted in an engine, which is run for three to four hours. Then a Geiger counter finds the amount of rubbed-off iron in the oil, an inverse test of lubricating efficiency. As little as one millionth of an ounce of metal worn from a ring can be detected.

Mightiest X-Ray Machine

X RAYS of 300,000,000 electron volts, the most powerful ever generated, stream from the world's mightiest synchrotron. Latest of University of California atom smashers, the machine artificially creates the mysterious cosmic-ray particles called mesons, duplicating with electromagnetic radiation the feat of the University's 184-inch cyclotron with speeding alpha particles. Below, Prof. Edwin McMillan, its inventor (left), and an associate adjust power supply to propel electrons at metal target, producing X rays.



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Constitution:

Sample of

PS reporter Devon Francis takes you for a ride in the world's largest air transport now in use.

NINETY of us walked up the ramp to board the Navy's giant Constitution for a nonstop flight across the country. Airplanes have carried more than 90 persons before, but never so fast and so far.

Ever since the Ford tri-motor appeared in the mid-twenties, I have been writing about "air liners." But the Constitution is the first transport that really lives up to the name. It symbolizes tomorrow's air travel.

It can tote 168 passengers. For comparison, the standard railroad coach seats 85. A railroad coach is about 9 feet wide, while the top deck of the Constitution is 11 and the lower deck 10. Together, the two compartments on the lower deck are 16 feet longer than a 69-foot railroad coach; the top deck is longer than a coach and a half.

We strapped ourselves in for the take-off. The four 3,500-hp. Pratt & Whitney engines coughed, caught, and roared. The airplane waddled out to the downwind end of the runway. She weighed, as she stood, 91½ tons. That was a lot to get airborne, even with her vast wingspan of 189 feet.

Slowly the rhythm of the engines grew. Our speed quickened. Then the take-off jets went to work. The floor tilted up slightly, the drumming from the runway stopped, and we were aloft.

The Constitution climbed fast. We soon topped 20,000 feet, and the altimeter was still winding up. Both upper and lower decks were pressurized to 10,000 feet. We began exploring the double-bubble fuselage.

Aft was the women's lounge and forward ("toward the bow," explained the attendant) was the men's—as big as you'd find in a Pullman. Forward was the galley, the size of the kitchen in a 4-room apartment. In it were a refrigerator, racks for utensils, a two-burner stove, a grill for heating snacks, and long cabinets to keep 300 meals hot.

I wandered forward, past crew bunks and Sparks, busy at his communications, to the spacious quarters of the flight engineer. A four-dial flowmeter showed each engine was burning a gallon of fuel every 30 seconds. The 480 gallons of gasoline we were using each hour would propel the av-

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Spaciousness of upper deck is shown above. In center is one of two stairways to lower deck.

Future Air Travel

erage automobile more than 7,000 miles.

In the nose were the captain and his first officer, deep in charts. Their crew was taking care of throttle and propeller settings; fuel mixtures; heat for the carburetors, the wings, fin, and horizontal stabilizer to prevent icing; and the navigation.

Except for some scattered Navy gear, the lower deck was empty. Along the sides of a deep well in the deck, half the width of the fuselage and fully 15 feet long, were intricate nests of tubing and wiring. Here were controls for four 15-kilowatt, 120-volt DC generators, turning out enough juice to supply 20 6-room houses, and tubing for three separate hydraulic systems. An axial-flow fan of 7½ hp., turning at 5,600 r.p.m., was supplying 4,400 cubic feet of air a minute to the plane's interior.

To anyone who has traveled chained to an airplane seat for long distances, the spaciousness of the upper-deck cabin was inviting. The aisle was wide enough for two persons to pass without squeezing. There was leg room to spare.

An hour from Washington National Airport an engineer from the Lockheed Aircraft Corp., builder of the Constitution, settled himself in the seat beside me. "Funny thing," he remarked, "but sometimes the pilots don't know when the wheels are on the ground in landing except by an indicator light. That's partly because of prerotation of the wheels. There are wind vanes on the tires to get them up to around half-speed. Then electric motors spin them to landing speed. That reduces the shock of the touchdown."

I put my tongue in my cheek. I had landed—whump!—in too many big airplanes.

By now we had lost most of our 23,000 feet of cruising altitude and were preparing to land. An officer announced on the loudspeaker system: "On landing we will be 9 hours, 35 minutes out of Moffett Field, California. Our average speed will be 268 miles an hour for the trip."

The glide flattened. Runway lights whizzed past the porthole. There was the merest tremor—and then the passengers burst into spontaneous applause.

"We can't be on!" I said.

The engineer grinned. "See what I mean?"

Devon Francis

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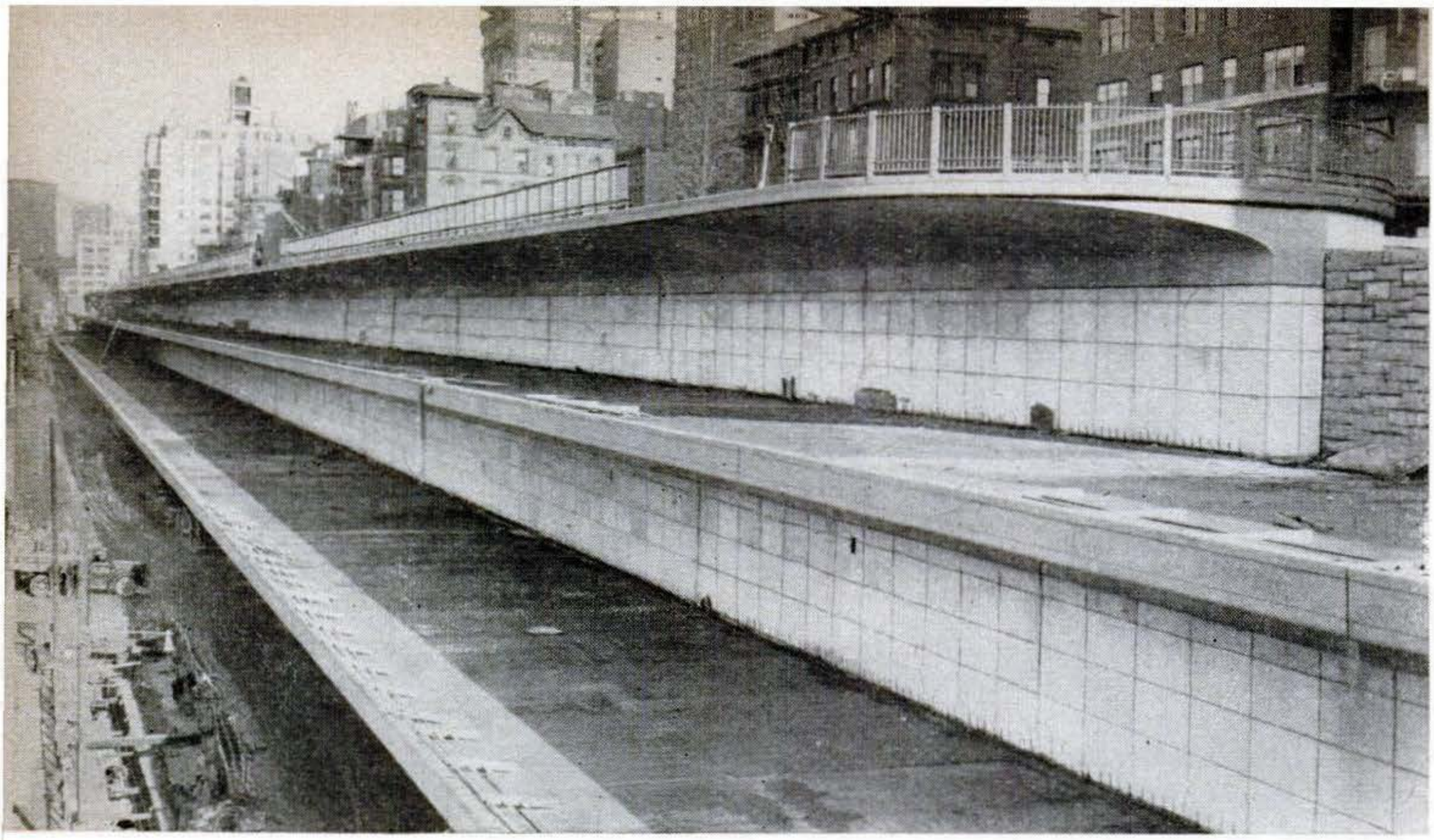
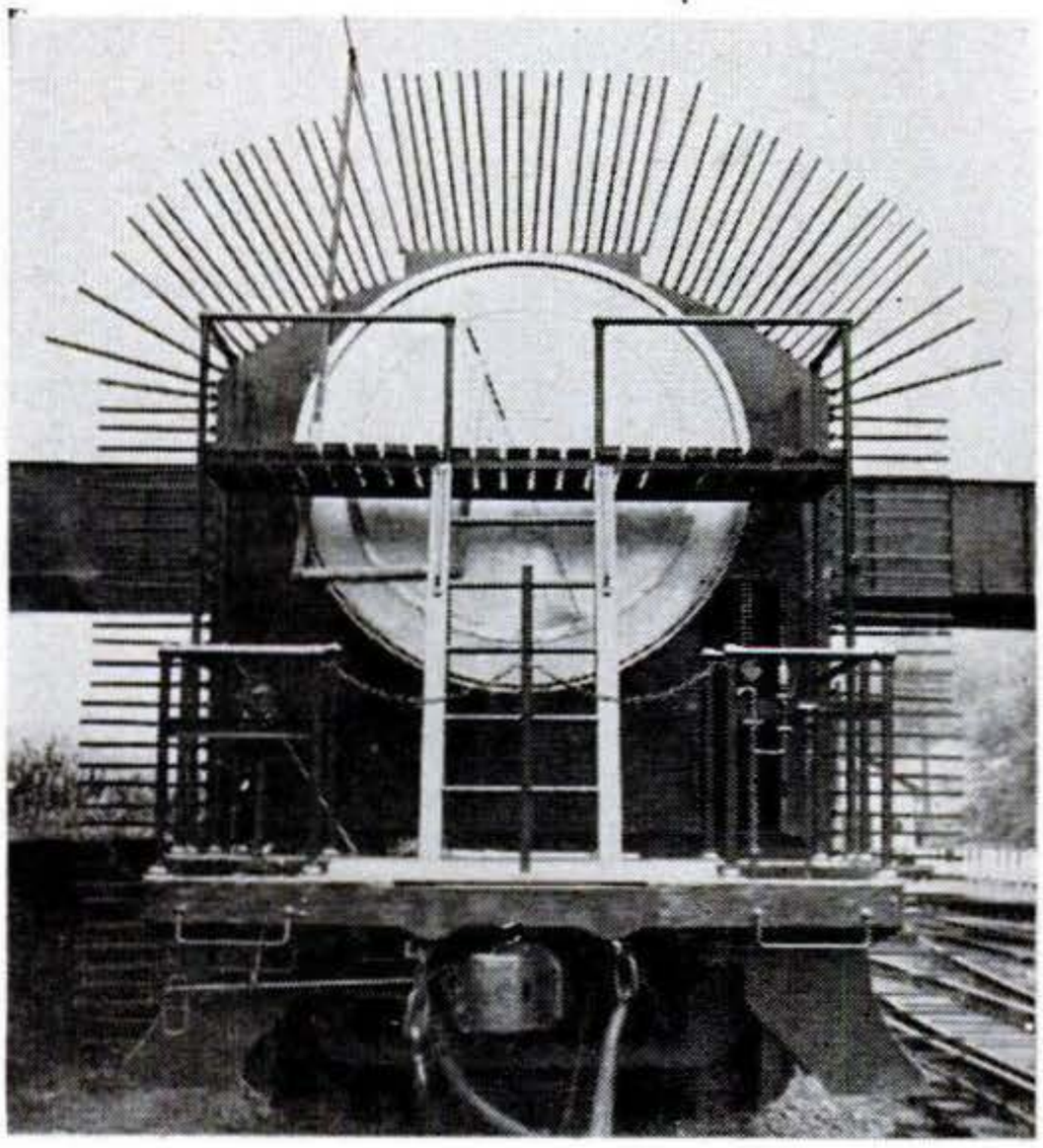


Street Has Three Decks

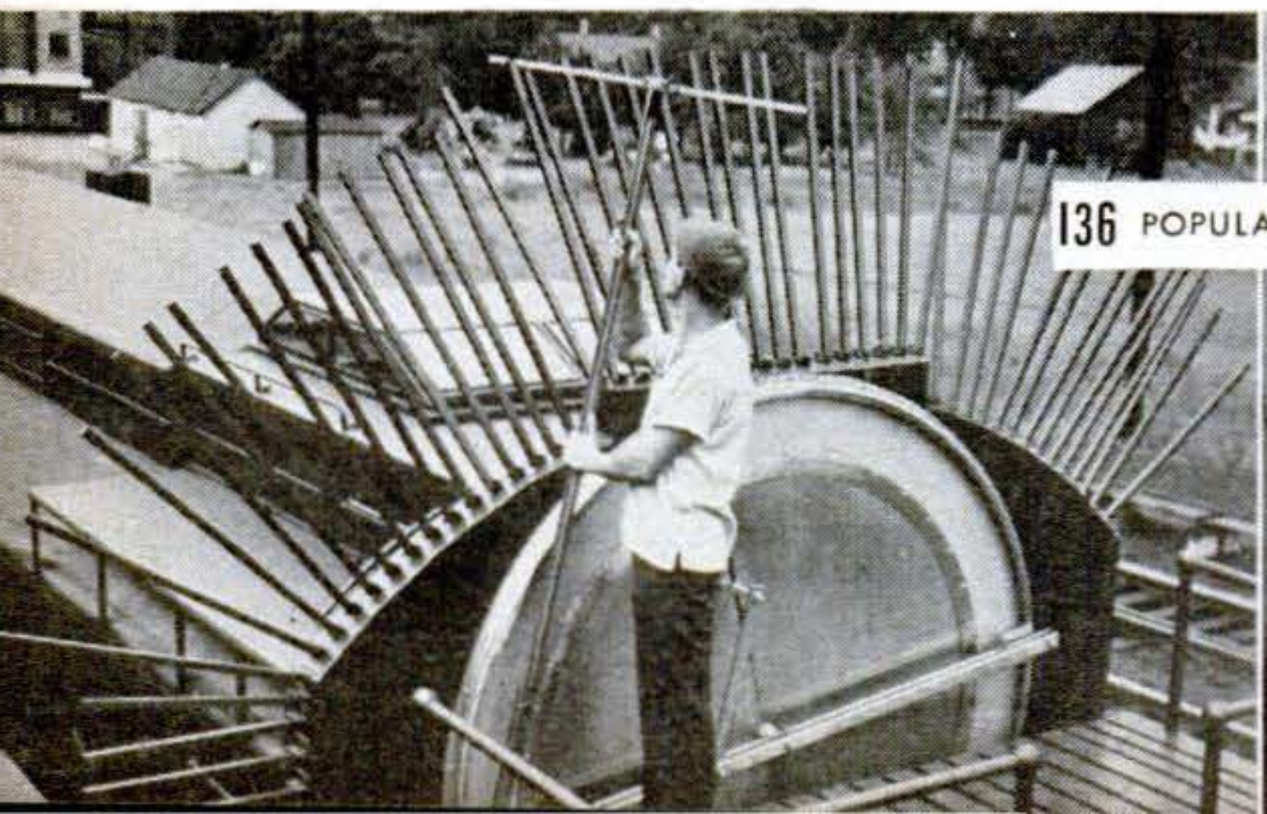
THIS three-layer street will speed New York City motor traffic unimpeded through a bottleneck between a steep cliff and the Brooklyn docks. Supported by a novel cantilever, the road on shelves will form a half-mile section of a highway to link La Guardia airport to the new Battery tunnel. The three decks, their undersides shaped to deaden noise, will provide north- and southbound expressways and a pedestrian walk.

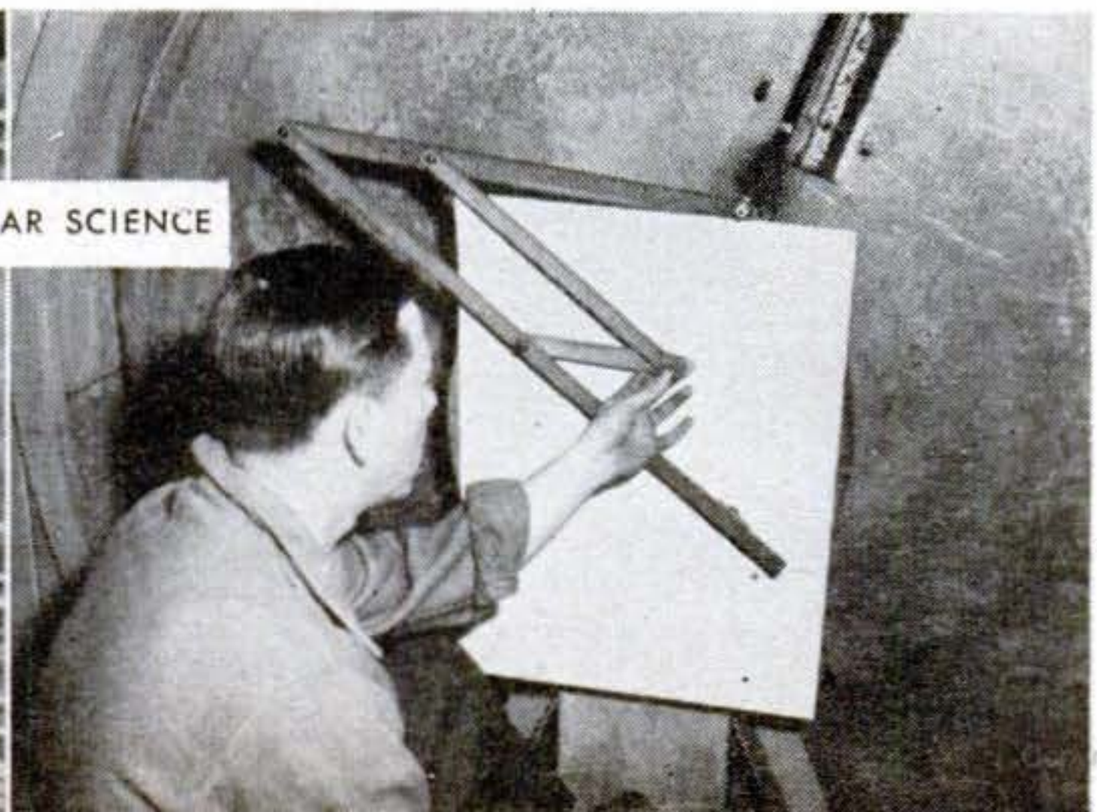
Porcupine Car Feels Its Way

Is a railroad tunnel big enough or a bridge high enough to take a train with an extra-high or extra-wide load? When the New York Central wants to find out, it dispatches the strange-looking car X800 shown at right to investigate. As the car goes through or under, the hinged wooden "feelers" bend back on contact with any obstruction. Later an arm is swung around them so as just to touch the tips of individual spines. This contour is recorded by a pantograph attached to the lower end of the arm and set in the circular plate at the end of the car. This is then translated into clearances.



Crew member at left below swings outside arm of recording device around spines. At right below, inside mechanism of the pantograph traces outline of the feelers on a sheet of paper.





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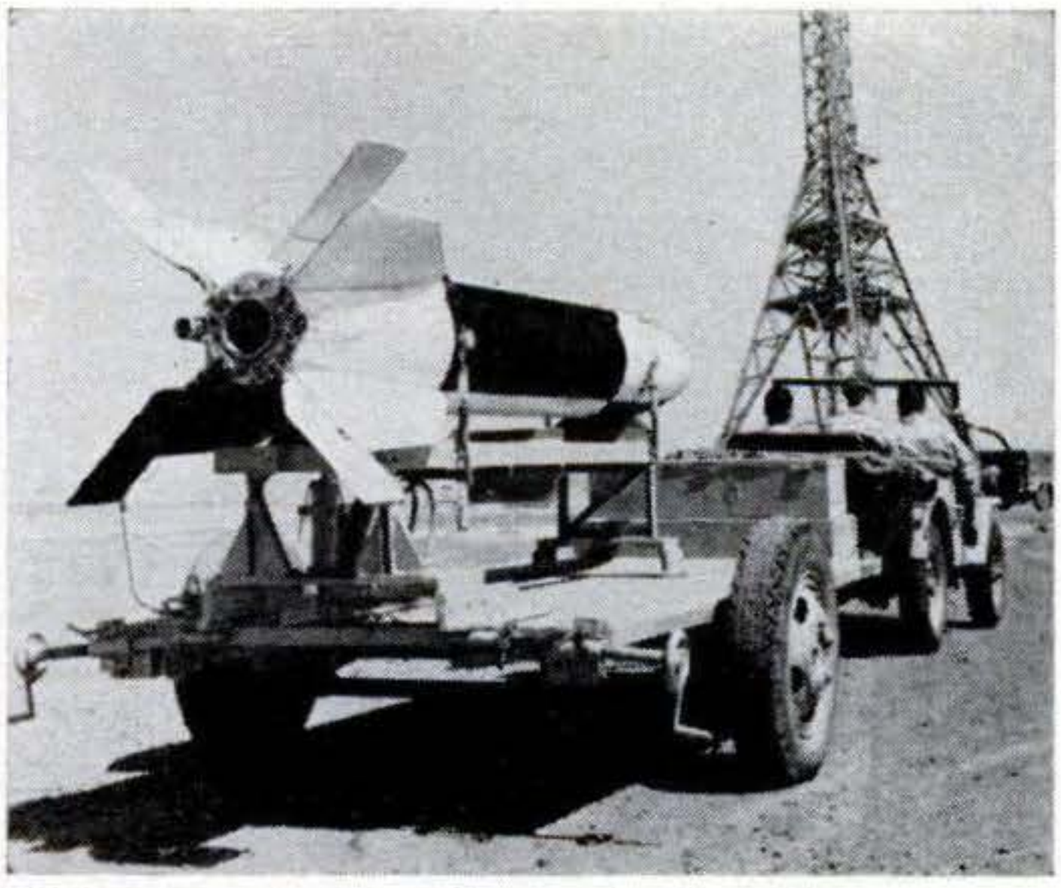
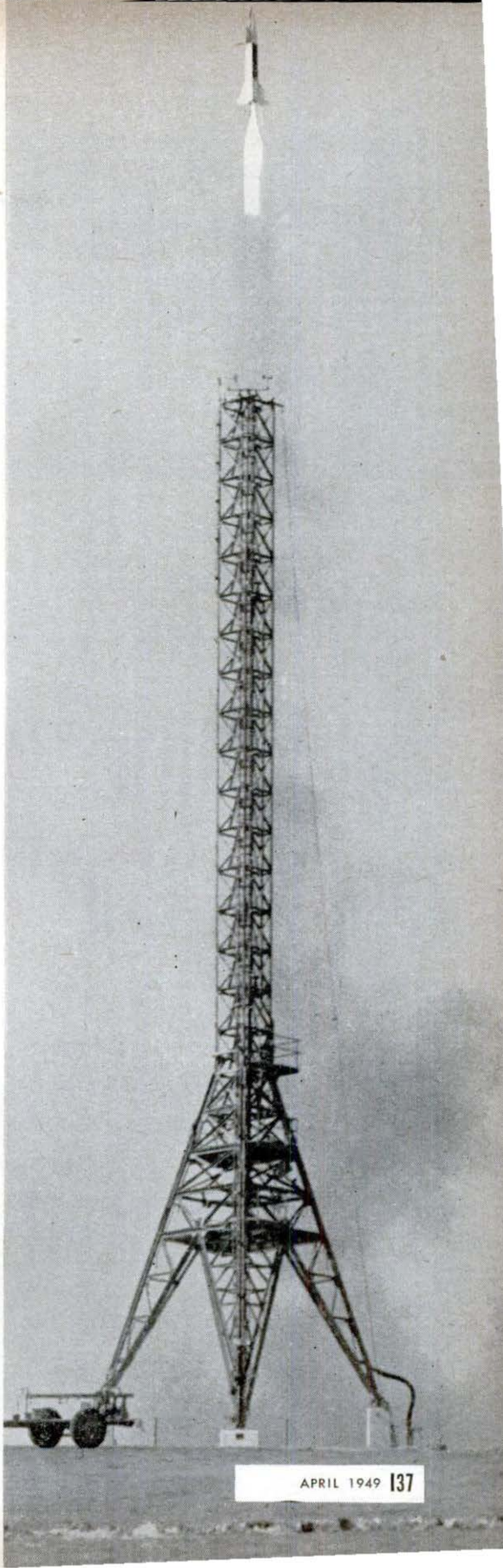
NATIV Trains Rocketeers

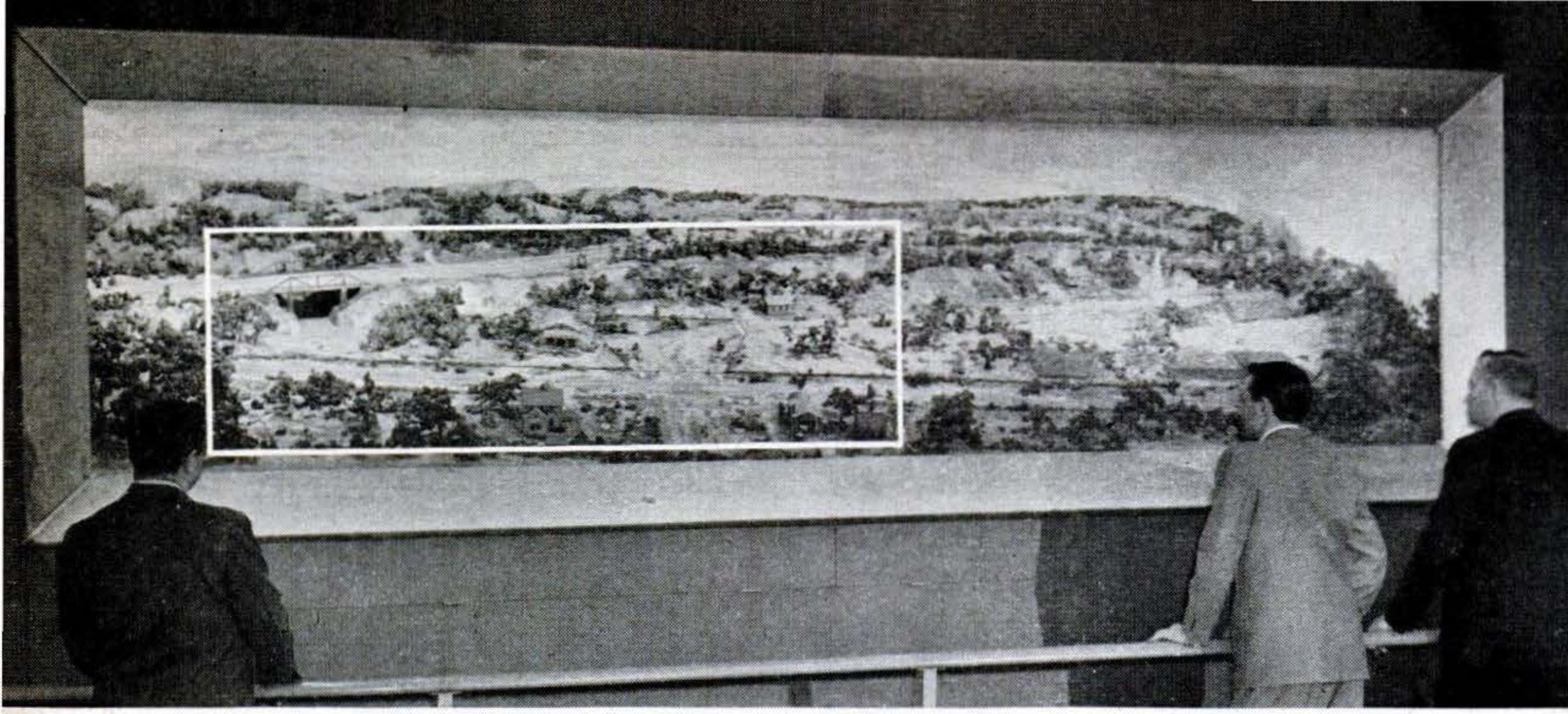
THE big rocket zooming straight up from the tower at right is the Air Force's newest guided missile. Called the NATIV, for North American Test Instrument Vehicle, it will be used for aerodynamic research, to devise better control systems, and for training rocket-launching crews. Liquid-fuel motors drive the needle-nosed missile, 13 ft. long and 18 in. in diameter, at speeds reaching the supersonic. It has already soared to more than 10 miles.



Riding on its cradle to the launching tower, the NATIV shows the four movable fins that provide controls during its guided flight.

Rocket is made ready, below, for firing through special metal launching tower whose rails guide it aloft during initial seconds of flight.





Spectator's view of the crossroads village shown in GM's diorama. Exhibit is 22 feet long, 7 feet deep. Area outlined in white is that shown in close-ups on the opposite page.

Motors Flip Model Town Into New Era

PS photos by W. W. Morris

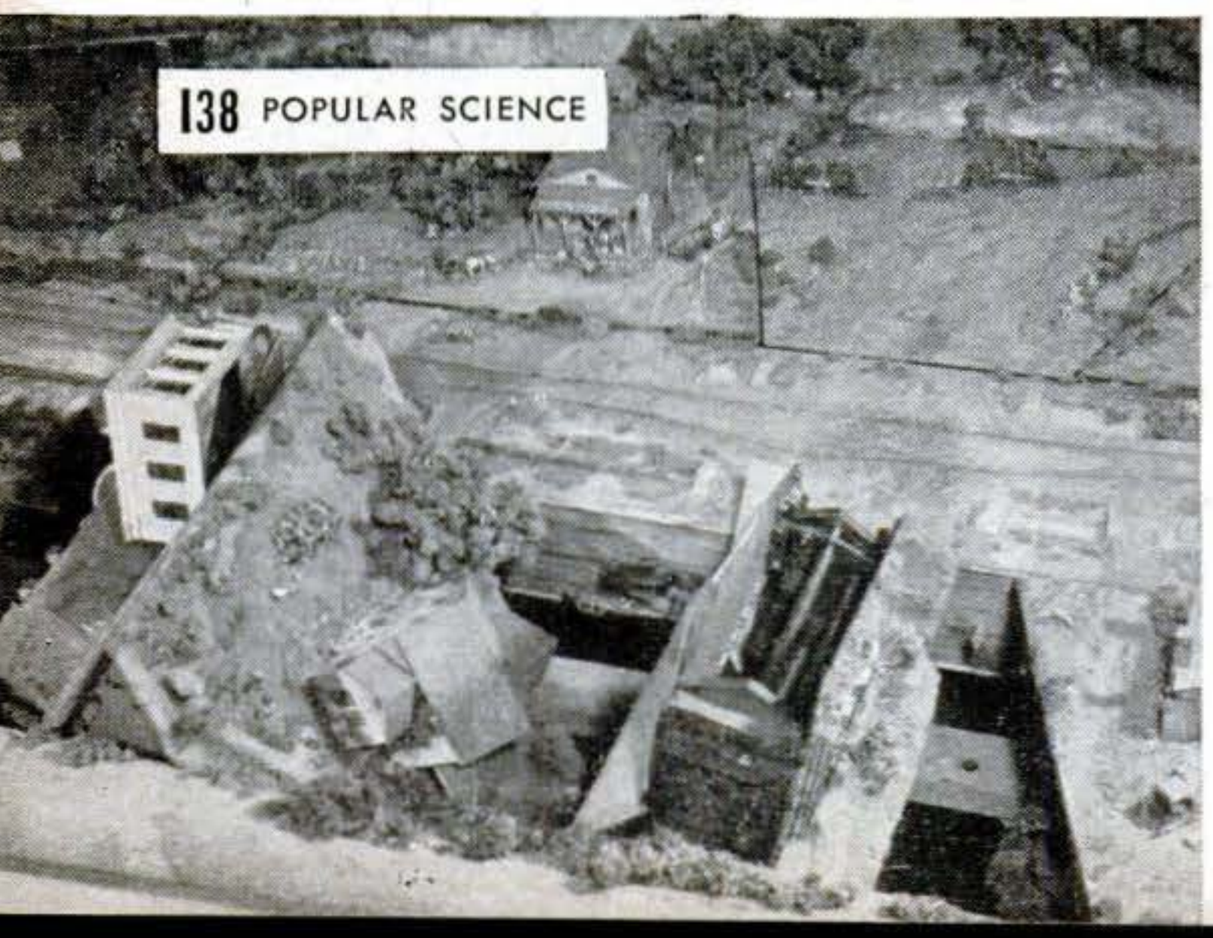
A DIORAMA that changes before your eyes to show the automobile's impact on a rural village is now touring the U. S.

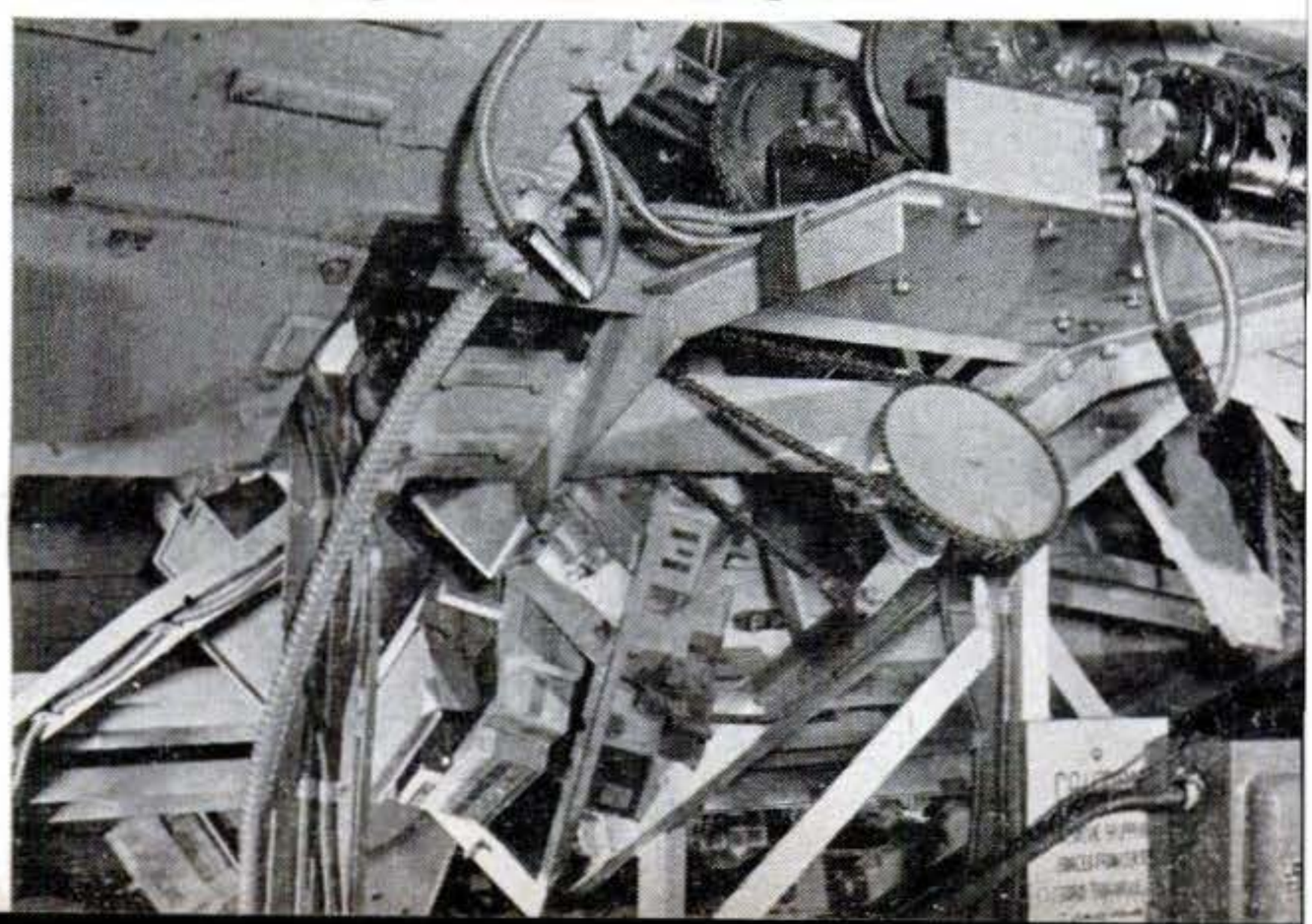
Twenty-eight fractional-horsepower electric motors shift scenes in the three-ton exhibit, called the "Parade of Progress," to keep up with a story told by a narrator. As the story unfolds, three-sided sections are flopped over, one-third of a turn at a time, to reveal new buildings, roads, and bridges, as well as snappier cars.

For traveling, the diorama is loaded into a special 17-ton truck. It has been seen by a half-million spectators in the last few months. Owned by the General Motors Educational Service, it was built at a cost of $40,000 before the war but had to be put in cold storage until 1948.

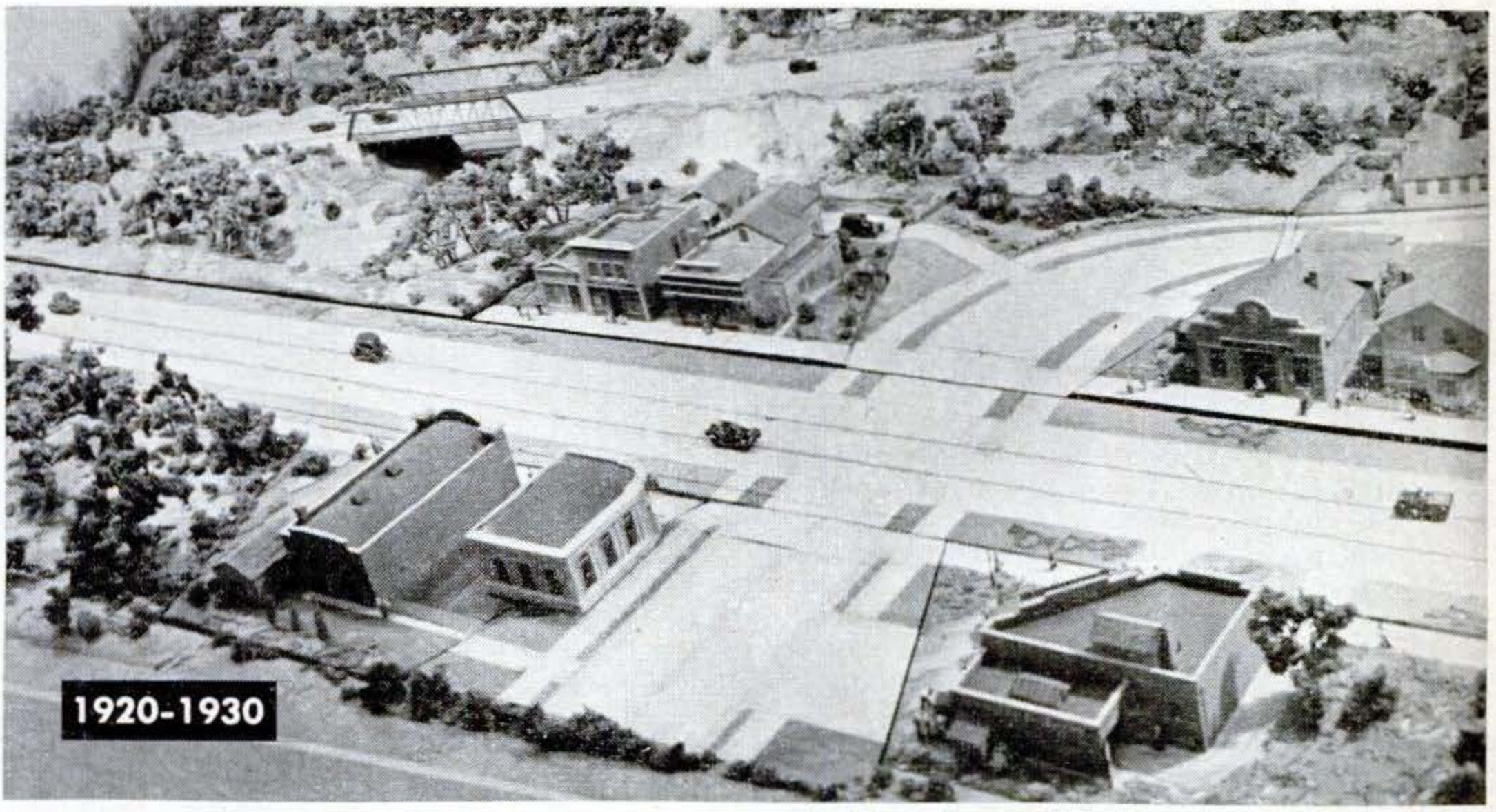
Sections of the village are turned automatically, as shown below, by 68 telephone-type relays kept in phase with a narrative on phonograph records. Three-sided cams under the display revolve at 33⅓ r.p.m., establishing 100 make-break contacts a minute. Since circuits are thus set on 1/100ths of a minute, animation can't get out of phase more than 6/10 second.

View of underside of diorama (below) shows one of the electric motors, with gears and chains for rotating sections of the exhibit, and chunks of landscape yet to appear. Switch to start diorama action is closed by the phonograph pickup arm as the narrative record begins playing. The show's cycle is 14 minutes, during which 64 changes of scene take place.





Close-up of diorama at start shows the muddy, rutted roads of forty years ago. Look closely and you will see the sharply defined outlines of segments that change with story.



Period following World War I comes into view as narrative progresses. Concrete roads, a new bridge, improved buildings, and modernized cars mark passage of the horse-and-buggy era.

Today finds highways filled with 1949 cars. New concrete bridge, spruced-up stores, enlarged theater, new post office, and fancy-pants service station change country's appearance.

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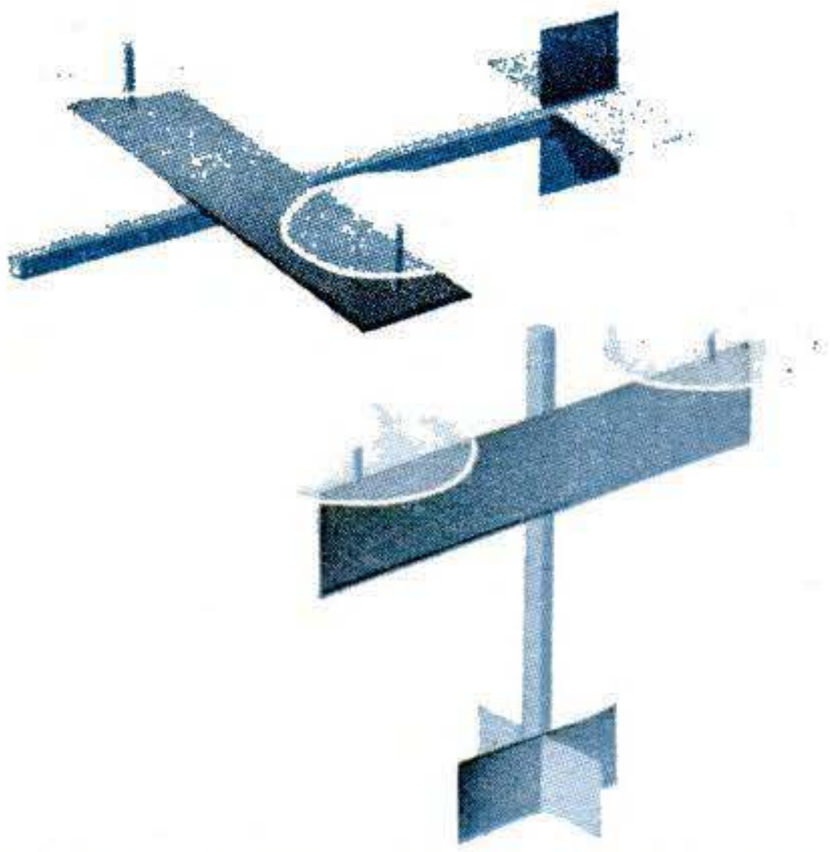
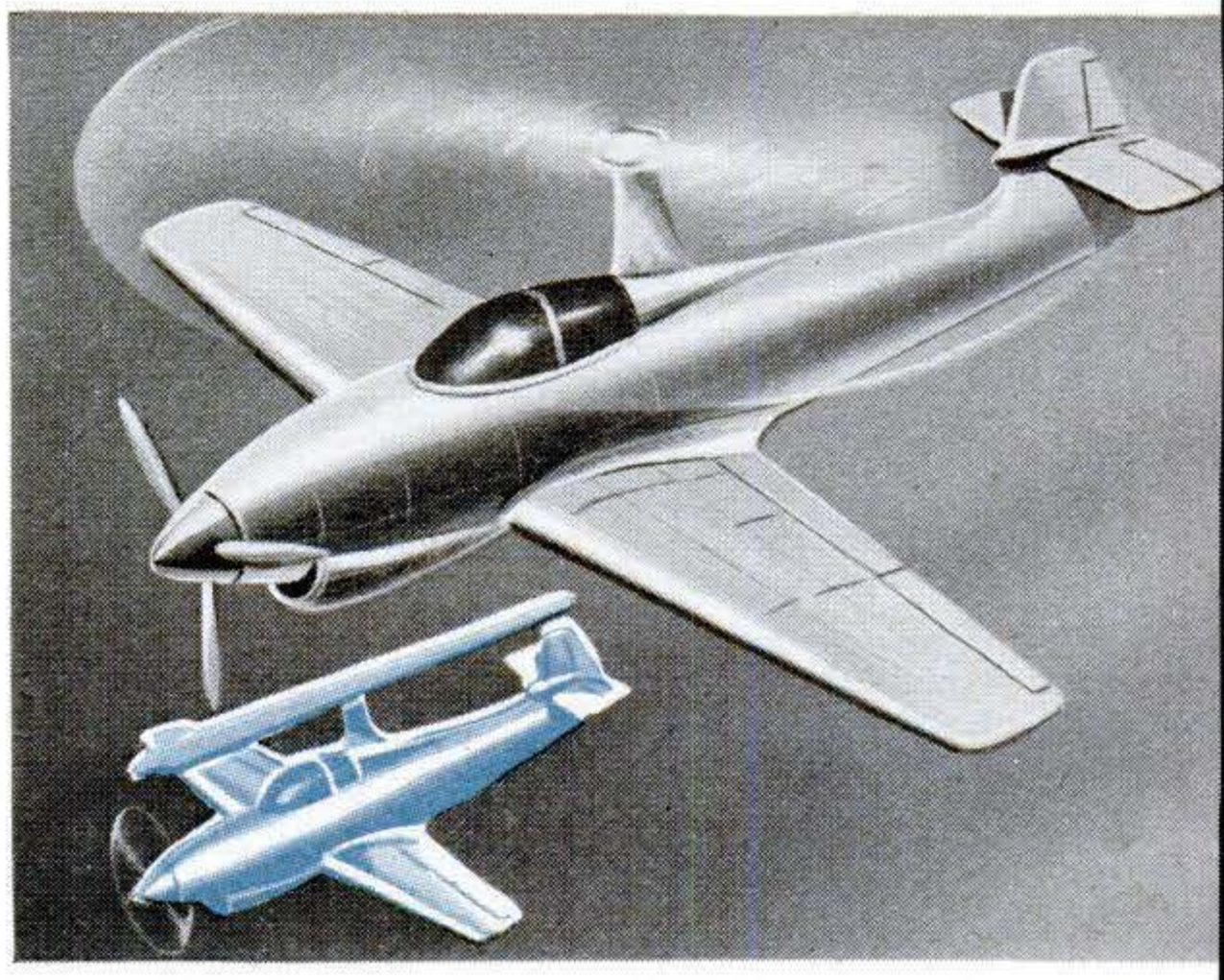
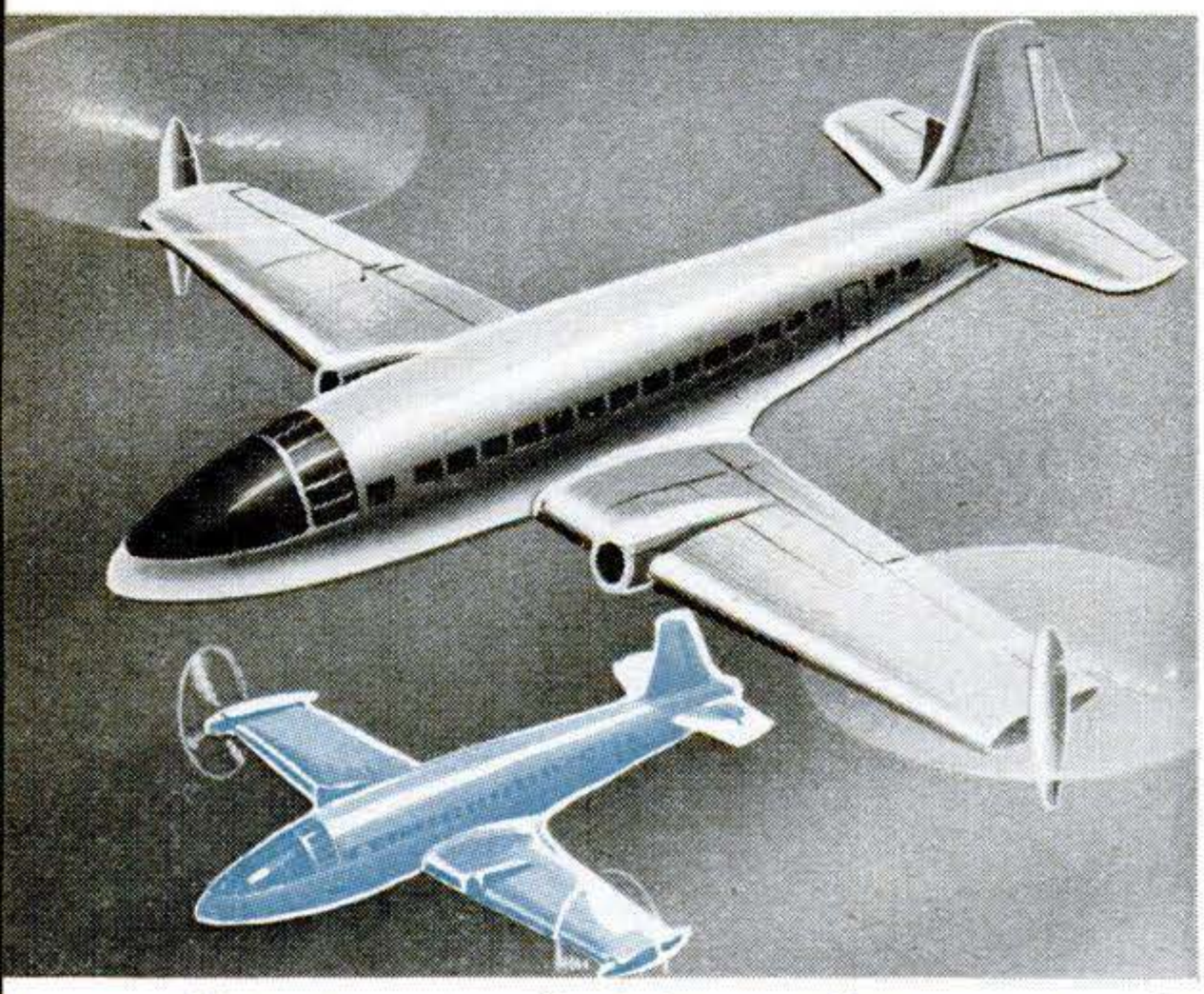
Propeller 'Copters Are Funny Birds



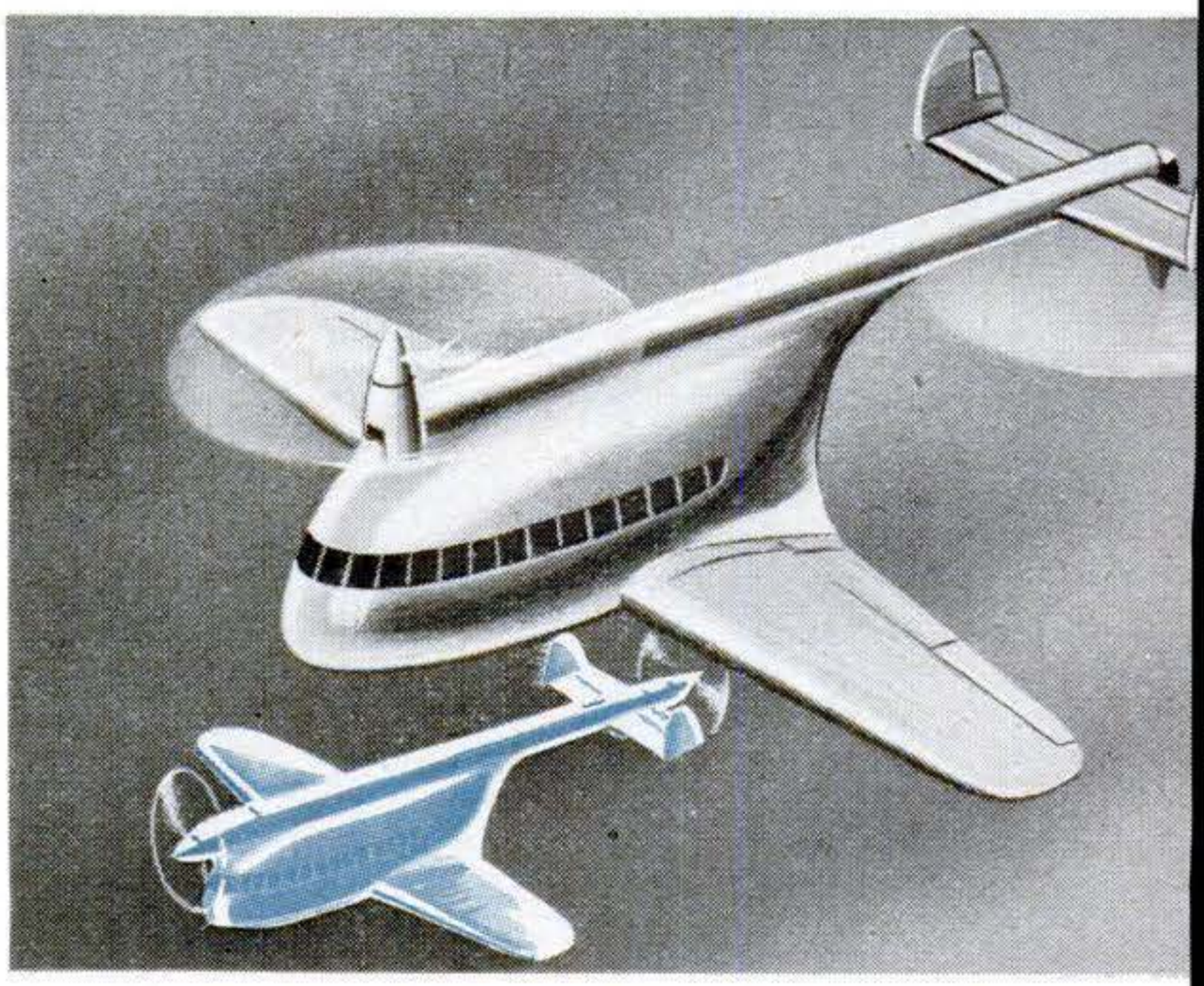
Three basic types of convertible planes are sketched above. Top one has separate rotor blade and propeller. In middle version, rotor blades pivot in mid-air to become propellers. Bottom one takes off vertically, then tilts over in flight to a horizontal position. At right and below are artist's conceptions of how these dual planes might look in flight.



Here we have a conventional-looking airplane with a jet rotor blade atop the fuselage. For forward flight, this blade is locked in low-drag position, and the regular propeller takes over.



Here the rotors for helicopter flight are pivoted from horizontal to vertical to become propellers for airplane flight. A small, experimental plane of this design is now under construction.



Another version of this type has been proposed by a French designer. As shown above, one rotor is placed forward and the other aft. They pivot to become a tractor and a pusher propeller.

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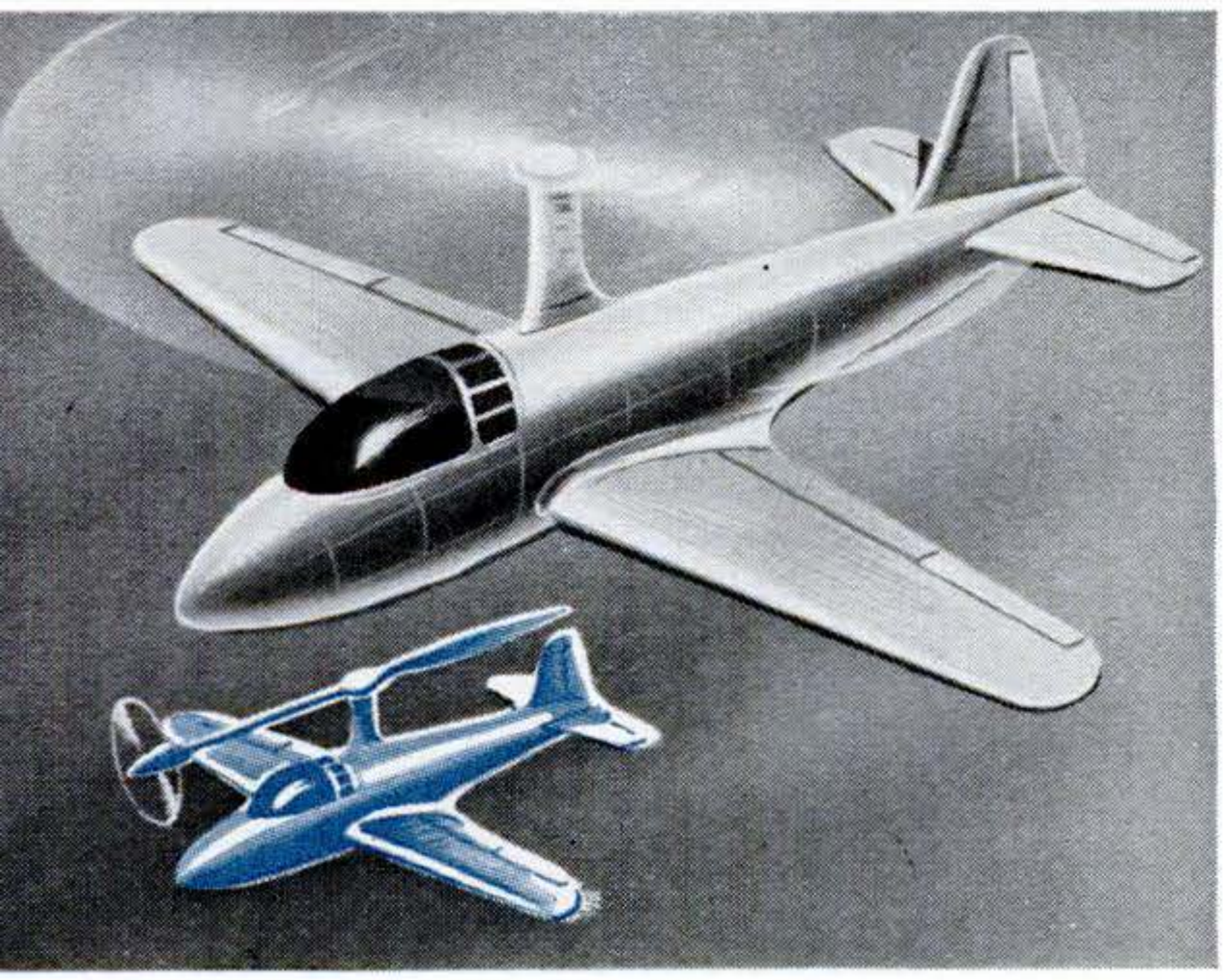
THE wedding of the helicopter and the conventional aircraft is a long way off, but even aeronautical engineers can dream —and in aviation, dreams have a way of coming true.

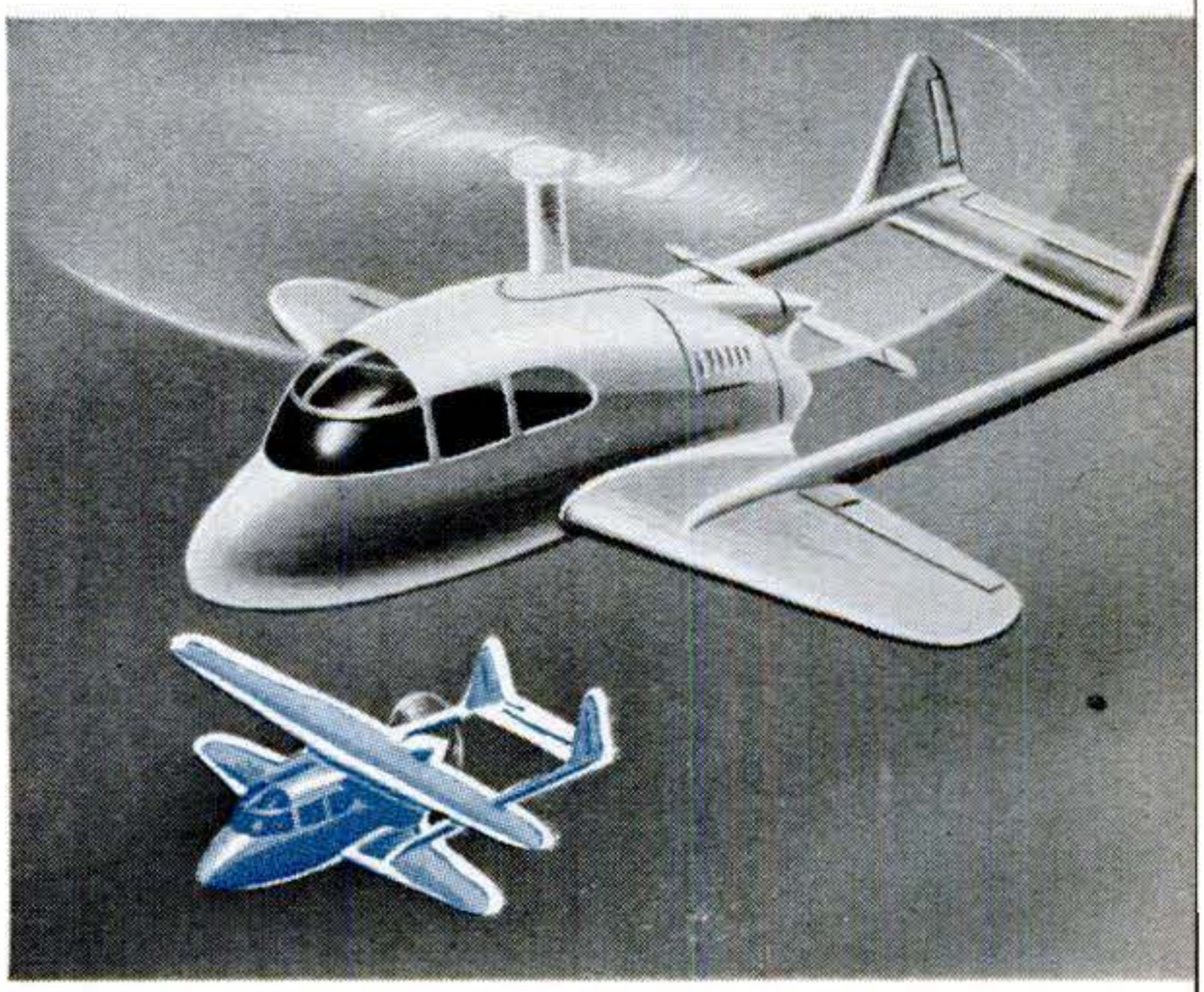
The ideal of the union is a craft that would rise vertically from your front lawn or garage roof, powered by a whirling rotor atop the fuselage. Then, at a safe altitude of a few thousand feet, this ideal aircraft would switch to horizontal, propellered flight at speeds of 450 m.p.h., or even faster if jet powered. At your destination, the switch would be reversed for a leisurely vertical descent.

One of the main problems to be solved is the mid-air transition from 'copter to fixed-wing flight. At that instant, the craft would be a "vagrant"—without visible means of support. But that's only one of the puzzles that enthusiasts of dual-purpose planes must solve with their slide rules and wind tunnels. So far, most experimental work has been confined to small models.

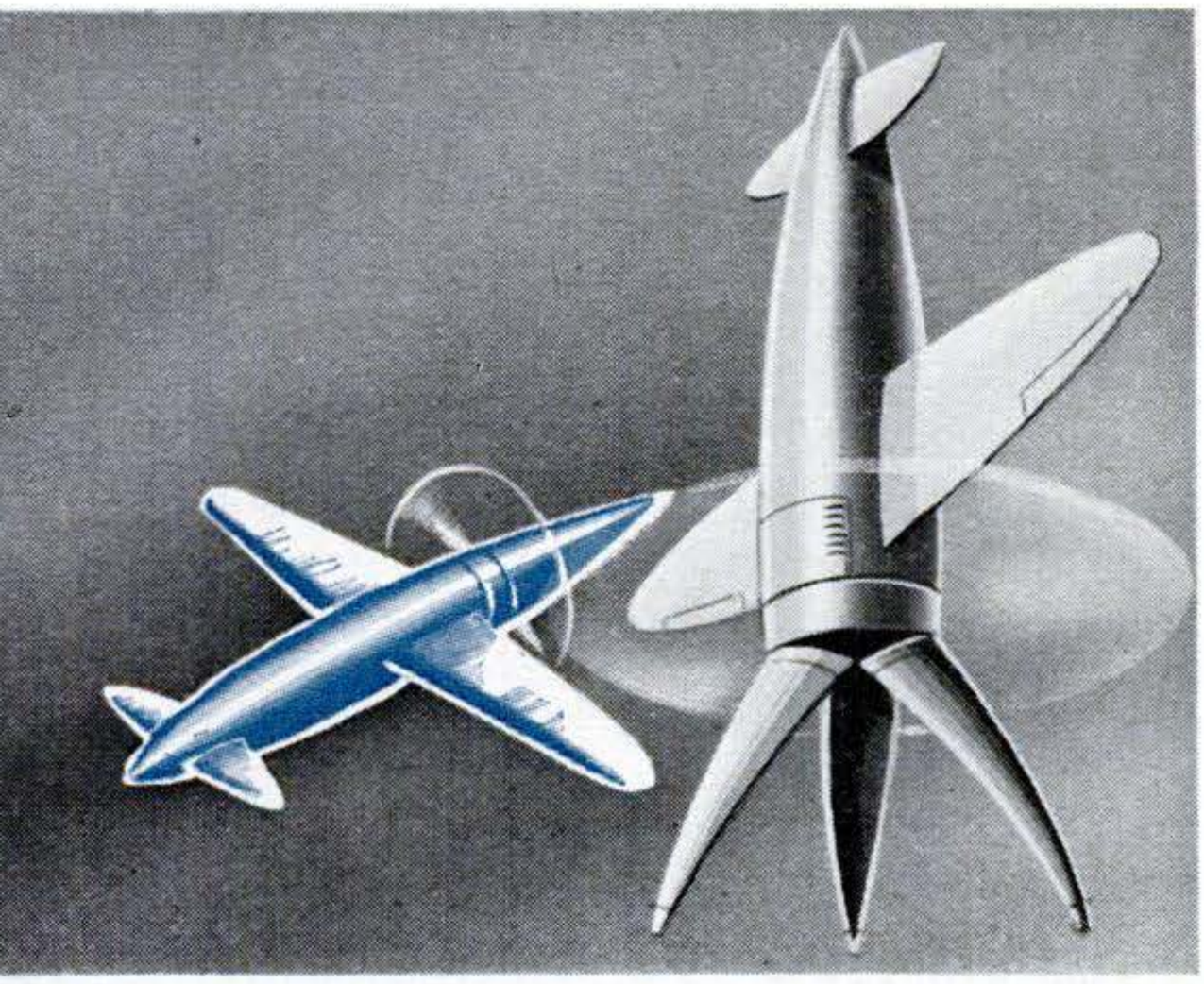
On these pages is a preview of how some of the air hybrids may look—and work. END



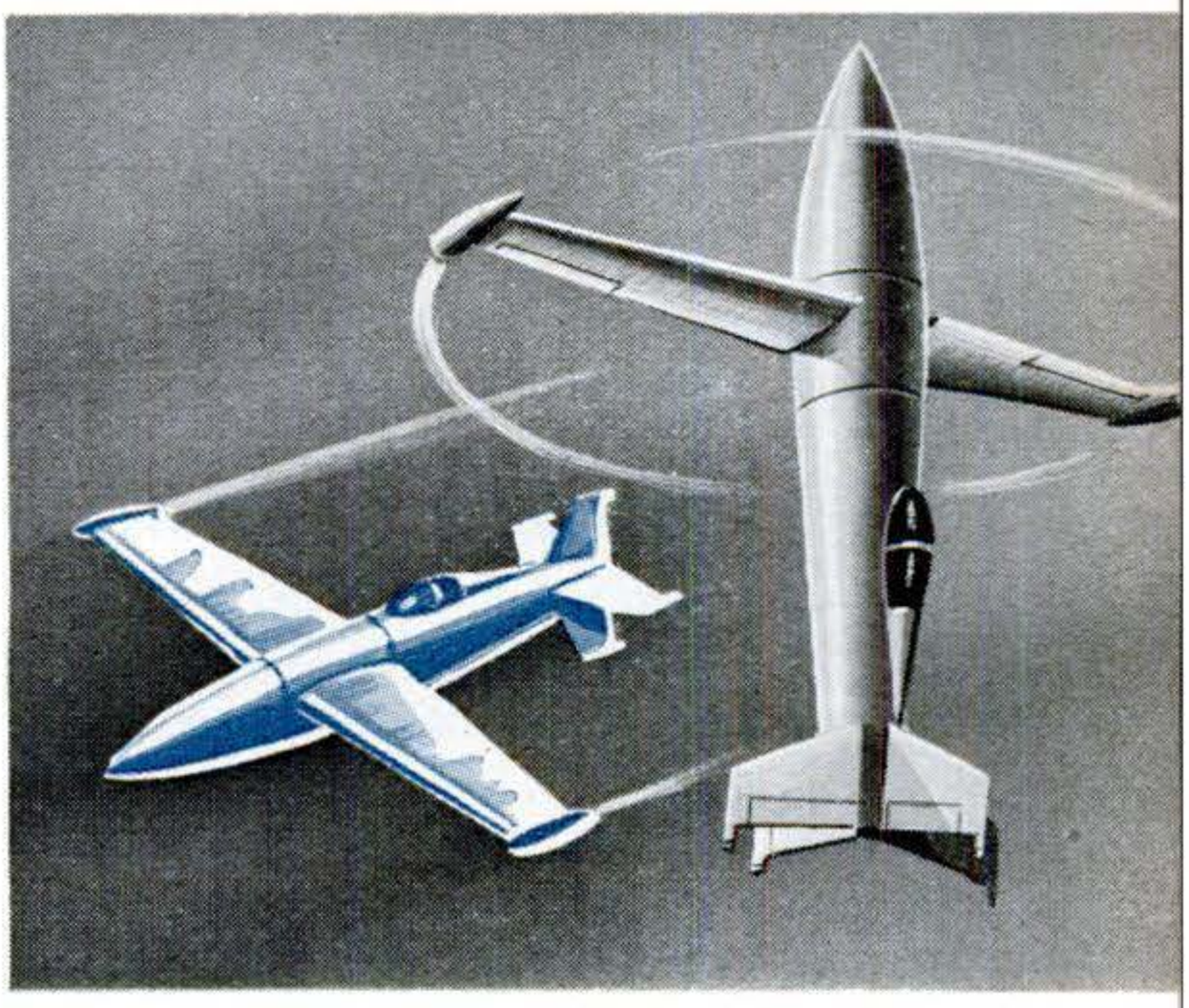
Similar in appearance, this version has prop drive shaft running through rotor blade. When blade is locked for transition, a swivel-mounted prop at blade's forward tip goes into action.



A full-scale Herrick Convertaplane® was flown as early as 1937. In this version, a tip-jet rotor blade becomes a second fixed wing when stopped. Conventional flight is with pusher prop.



Three-pronged nose in the craft above is landing gear for helicopter take-off and descent. For horizontal flight, it folds in, the whole plane levels off, and the rotor becomes a propeller.



This streamlined variation also takes off and lands vertically. In transition from helicopter ascent, the jet-tipped rotor blade pivots and becomes the fixed wing for horizontal flight.

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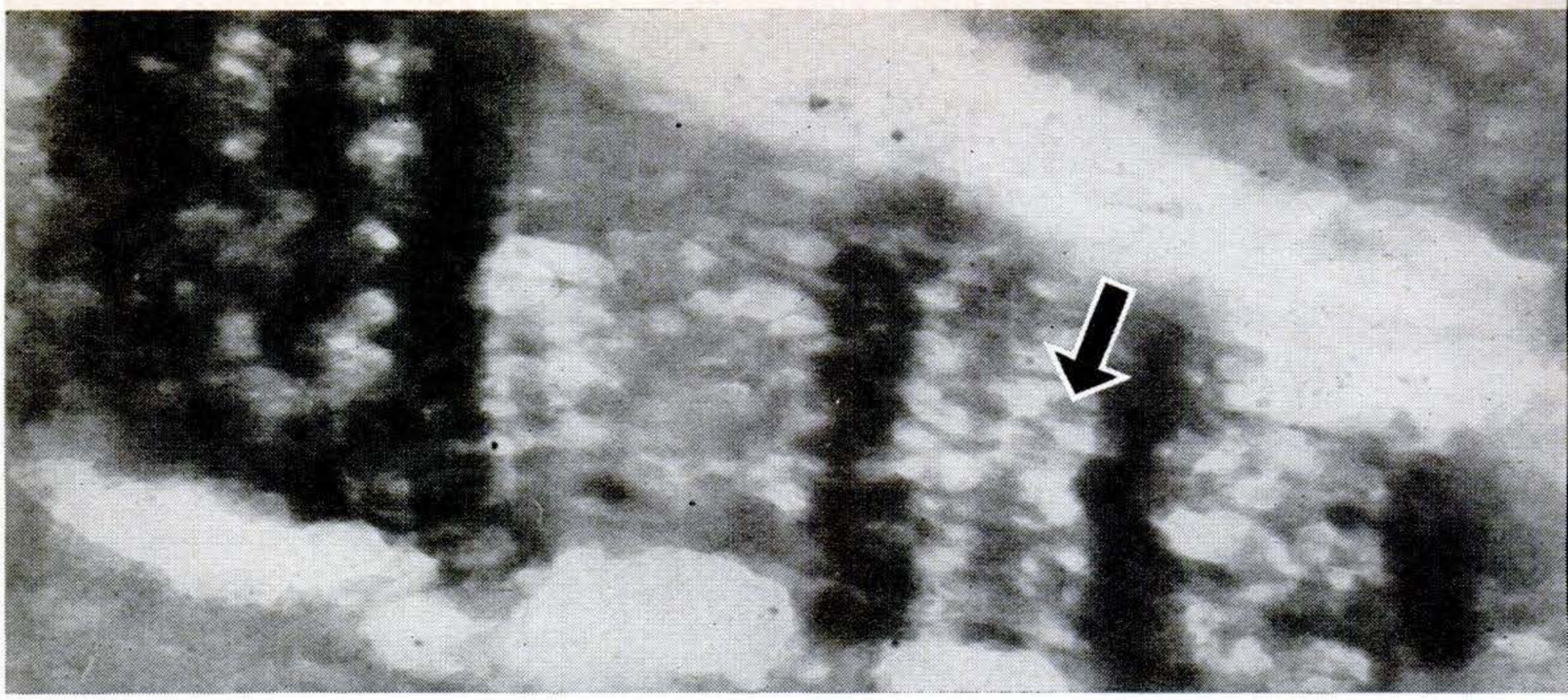
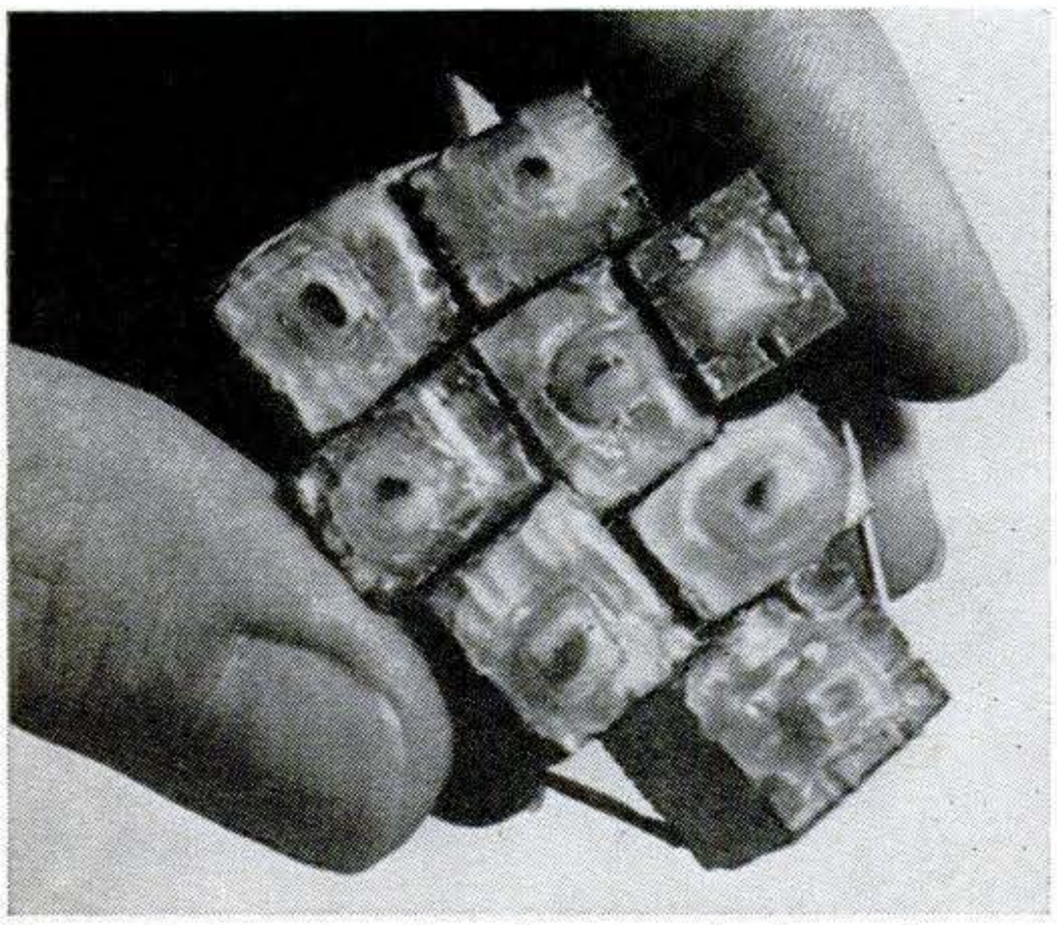
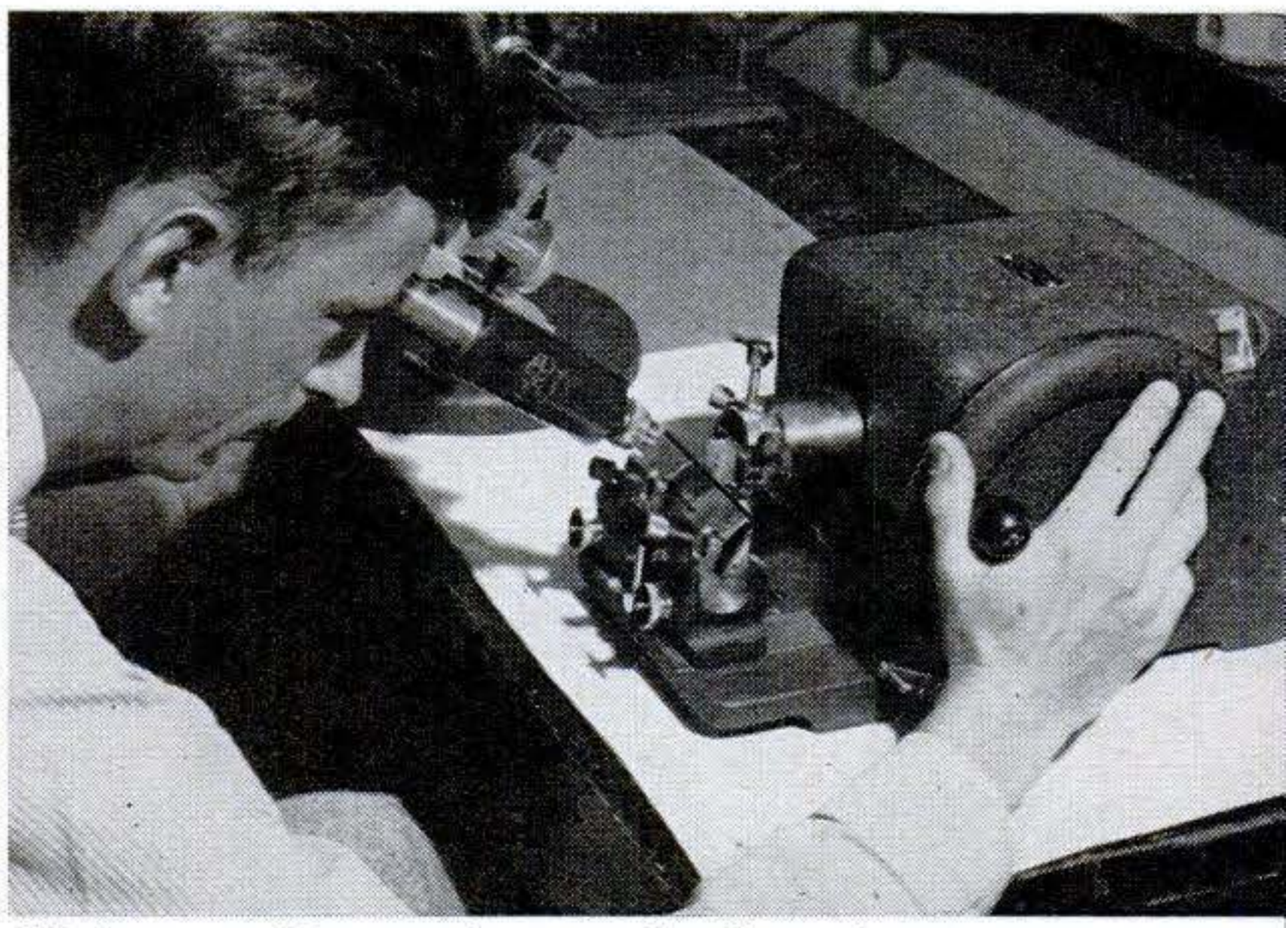


Arrow points to one of genes in fruit-fly tissue enlarged 43,667 times by electron microscope.



Bits of tissue to be photographed in electron microscope are stiffened for slicing by imbedding them in collodion and paraffin. Blocks are frozen by fumes of carbon dioxide from dry ice.



Slicing machine with new ultrafine adjustment presses imbedded tissue against sharp knife that shaves off layer only 1/250,000 in. thick. Operator watches through ordinary microscope.

1/250,000-Inch Slice Traps Genes for Camera

THOSE fantastically tiny particles, called genes, that determine such traits as the color of your hair and eyes, and whether you are a man or a woman, have now been photographed for the first time. The way this was done opens important new fields for medical research.

The first gene pictures were taken by two young scientists at the University of Southern California, Dr. Richard F. Baker and Dr. Daniel C. Pease. Their achievement caps 50 years of efforts in laboratories all over the world to get an actual look at the mysterious carriers that transmit physical characteristics from one generation to the next.

Genes are smaller than the wave length of visible light. This meant that they could never be seen through an ordinary light microscope, no matter how powerful. That

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difficulty was overcome, in theory, by development of the electron microscope (PS, July '48, p. 122).

Solving the first problem, however, only created another. The magnetically focused beam of electrons, which the super-microscope uses instead of rays of light, will not effectively penetrate a specimen thicker than about 1/250,000 of an inch. But the thinnest anybody had been able to slice animal tissue was only 1/25,000 of an inch.

How, then, to slice meat ten times thinner than ever before? Drs. Baker and Pease managed that in two steps.

First, they imbedded the tissue in a block of paraffin mixed with collodion. Paraffin alone, previously used, was too brittle to slice ultrathin; and collodion alone was too elastic. Together they worked fine.

Second, the two U.S.C. researchers built an extra-fine adjustment into a microtome, a standard laboratory machine used to slice thin specimens of tissue for ordinary microscopic examination.

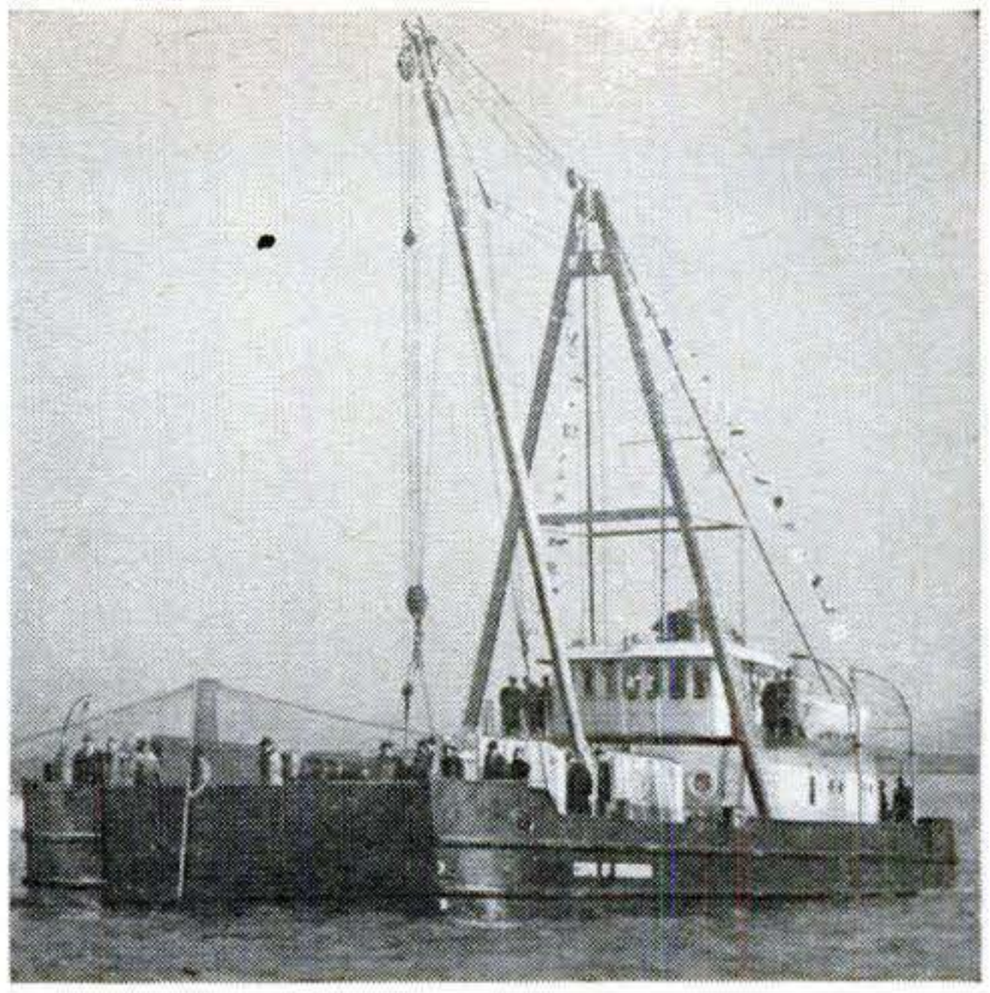
How Slicer Works

This attachment consists of a flat metal plate attached to the carriage of the slicing machine at a slight angle to its knife. When the crank handle of the machine is turned, a large pin slides over the angled surface and pushes the carriage a few millionths of an inch forward. The block of imbedded tissue then is pressed down on the knife, which shaves off a slice thin enough even for the electron microscope—and so delicate it must be handled with a camel's-hair brush.

For their first photographs of genes, the two scientists used cell tissue from a fruit fly. This insect is the favorite subject of students of heredity because it breeds successive generations 500 times as fast as human beings do.

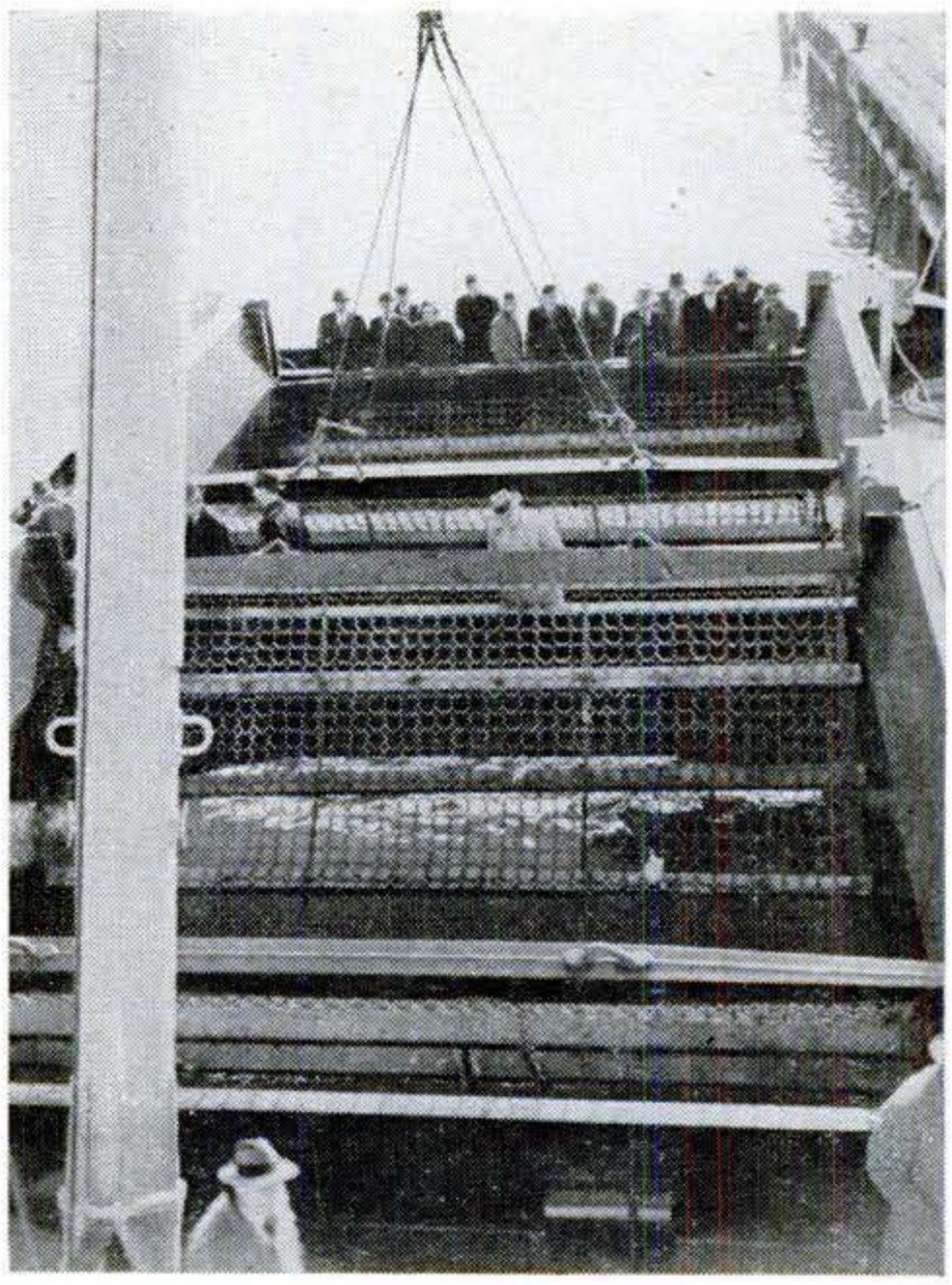
Fruit-fly genes, believed to be similar to those in people, turn out to be spindle-shaped particles about 1/100,000 cm. long and 1/1,000,000 cm. wide.

But more important than those facts is the new slicing technique that made possible their discovery. A single red blood cell may now be sliced into 35 layers for detailed studies of its makeup. Internal details of bacteria and cancer cells will come to light under the bombardment of electrons. And by photographing slices of nerve cells, medical researchers hope to find out exactly where the virus of poliomyelitis—infantile paralysis—does its damage. END



Port Sweeper Nets Debris

THE Army Engineers designed this odd-looking vessel, the *Driftmaster*, to keep New York Harbor swept clear of floating debris that menaces ship traffic. Driftwood is scooped up by two steel nets suspended between twin hulls bridged by the superstructure. One net at a time is pushed through the water with its lower edge just below the surface. When loaded, both are dumped by the crane into an incinerator barge. Two 300-hp. Diesels drive the craft.



Two nets are raised and lowered separately by hydraulic gear. When forward net has been filled with driftwood, it is lifted up and second net is let down to skim surface.

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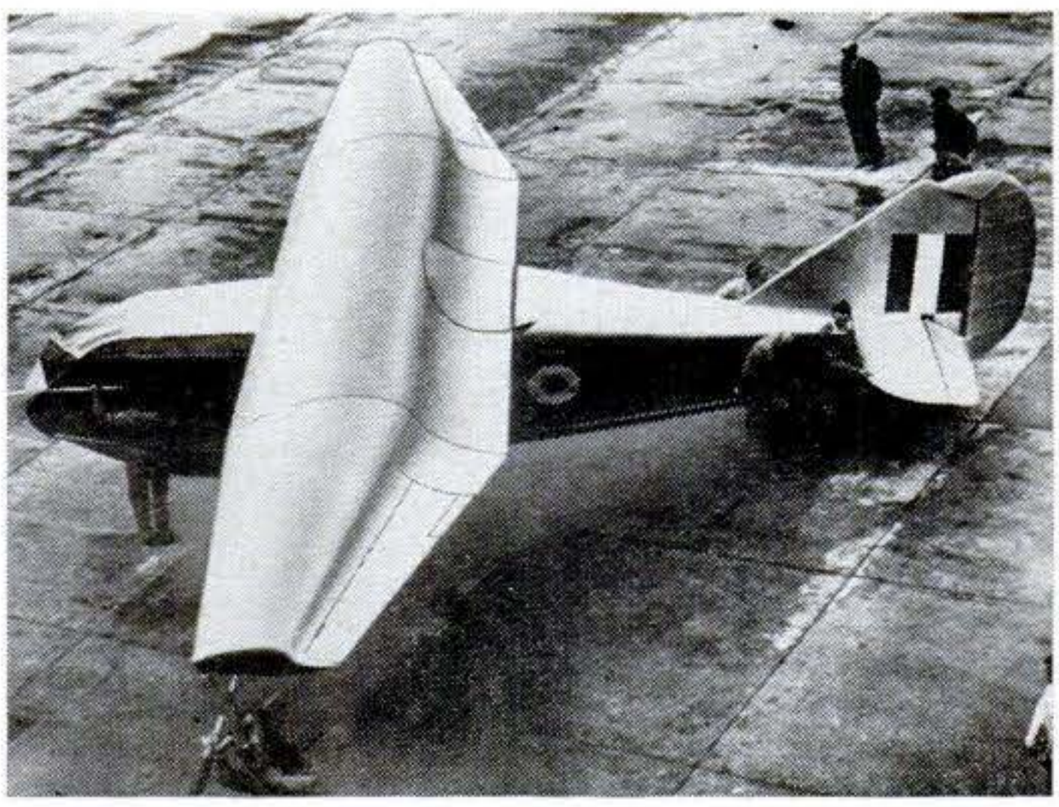
What's New in Aviation

Argument for Turboprops. Above is the world's first air liner to fly on propeller-turbine engines alone. It is the Vickers-Armstrong Viscount®, Britain's No. 1 argument in favor of turboprop power for commercial planes. Advantages claimed are: that the engines give more power per pound than piston engines; that, being smaller, they cause less drag and therefore give more speed; that they burn kerosene, less inflammable and cheaper than gasoline; that with lighter propellers vibration is lessened. The 32-passenger, 350-m.p.h. air liner is now undergoing flight trials.

Wing Tips Get New Job. Bulbs on the ends of this Fairchild C-119 cargo plane's wings are not fuel tanks, but experimental radio-radar domes. Designed for the Air Force, the plastic wing-tip housings contain electronic equipment that ordinarily would take up cargo space. Each of the "radomes" weighs about 200 pounds. One holds radar units for aircraft detection and ground search in bad weather. The other, containing radio equipment, balances the plane and eliminates exterior antennas.



Australians Try Suction Wing. While high-speed jet planes are calling for thinner and thinner wings, Australian aeronautical engineers are experimenting with a thicker wing. Shown installed on a glider, it is twice as thick as that of a standard transport plane. As air flows over the concave part of the wing, part of it is sucked in through slots by a fan. The theory is that this will give added lift and jet thrust. Because of its thickness, the wing may prove suitable for all-wing planes.

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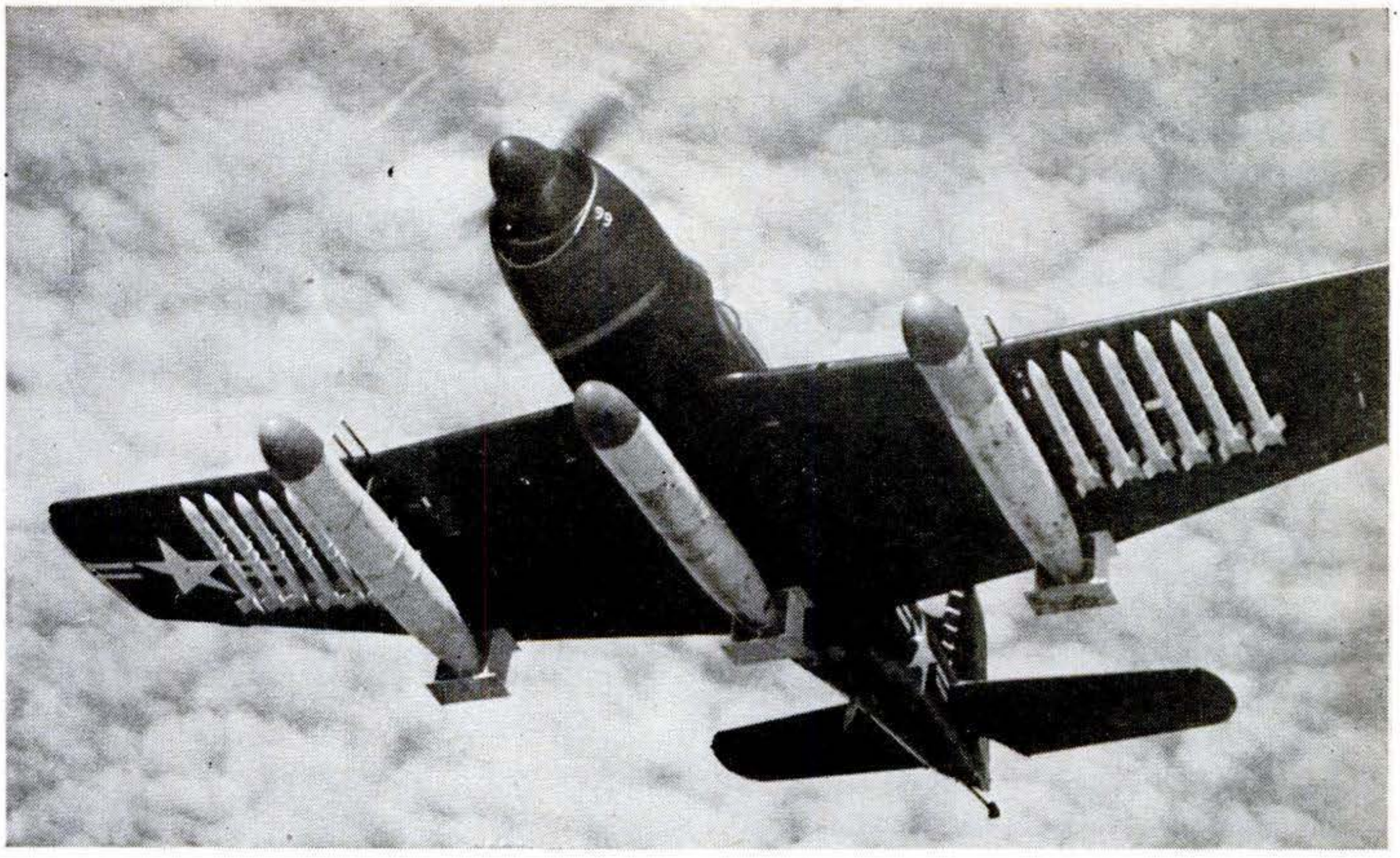
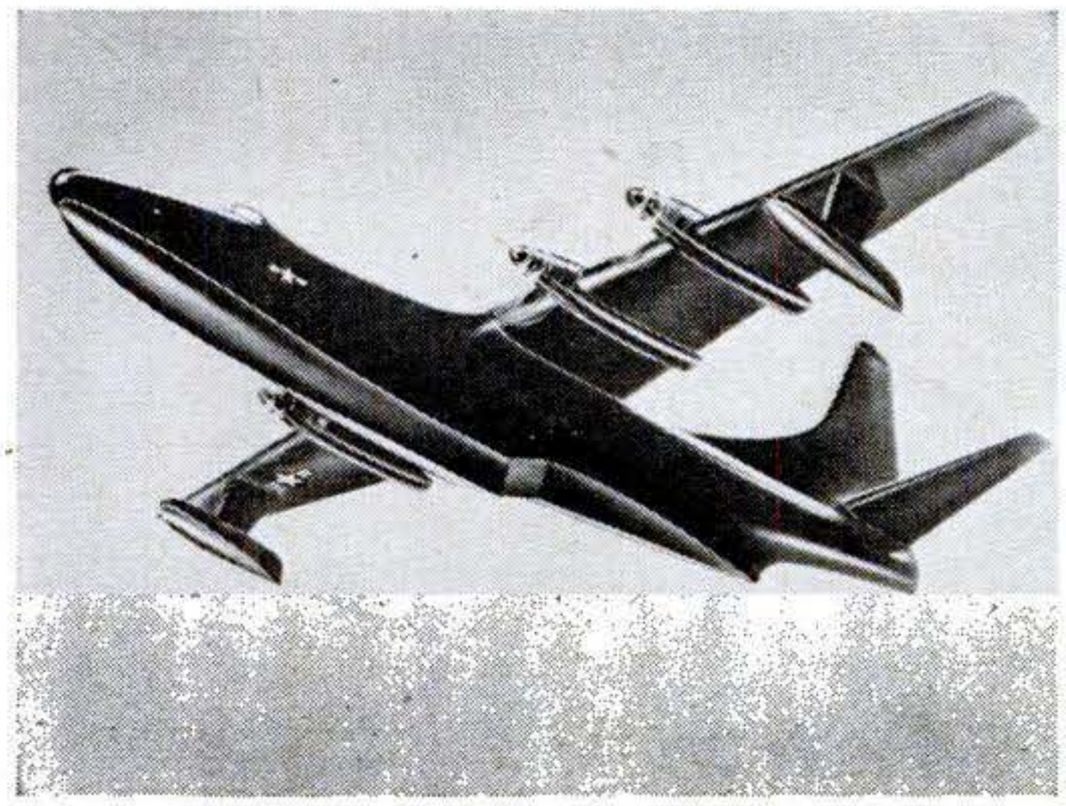
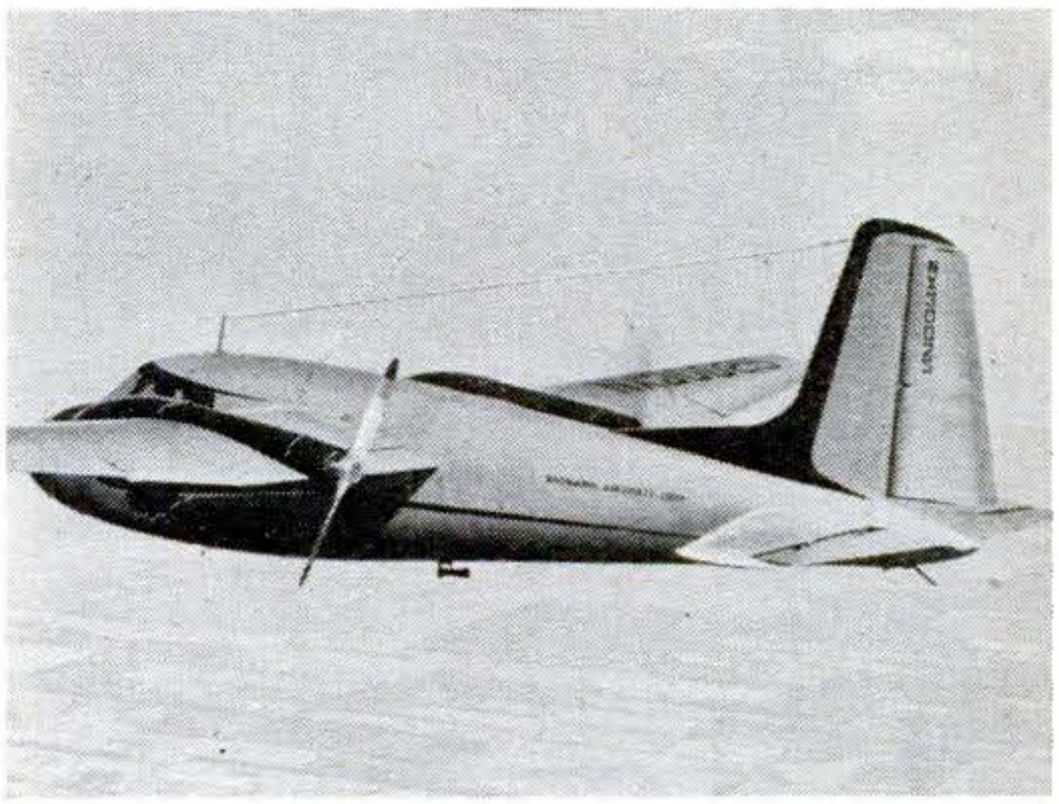


Firepower Under the Wings. This is "Able Mable," the Navy's new one-man flying arsenal. She's the Martin AM-1 Mauler, and she carries the greatest firepower ever packed into a single-engine, carrier-based aircraft. As shown above, 12 five-inch rockets and three 2,200-pound torpedoes are shackled under the wings. Four 20-mm. cannon are built into the leading edges. The 350-m.p.h. plane is powered by a 3,250-hp. Pratt & Whitney Wasp Major® engine. It has a take-off weight of over 25,000 lb.—more than a 21-passenger, twin-engine plane—and a range of over 2,000 mi.



More Power, Greater Speed. Four Allison turboprop engines will provide this Navy flying boat with more take-off power per pound of plane than some fighters. Sketch above shows the high length-beam ratio that will give the XP5Y-1 excellent hydrodynamic characteristics. Designed for long-range sea searches, rescue operations, and anti-submarine patrol, two of the flying boats are being built by Consolidated Vultee. Their design was speeded by tests with a radio-controlled scale model.



One Engine Keeps It Flying. You wouldn't have to worry about getting home if one of the two 125-hp. Continental engines of this new executive transport conked out, as shown above. The plane is the Brigadier 250®, designed by Jack Bauman, of Burbank, Calif., and recently announced ready for production. The all-metal, pusher-type craft seats five people. Its range is 750 miles: cruising speed, 150 m.p.h. The plane's baggage space is so roomy that coats can be hung up full length.

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What's New in Aviation

Shortstop for Jet Bomber. A parachute airbrake slows the Stratojet, world's fastest bomber, as its wheels are about to touch down on an icy runway, where wheel brakes are useless. The 30-foot 'chute is stowed in the tail of the 600-m.p.h. Boeing B-47 six-engine jet bomber and released just before landing. The idea was suggested by Major Guy M. Townsend, the plane's pilot in braking tests.

Check-Pilot in a Box. A new type of flight recorder, sensitive to altitude changes as small as 10 feet, is being adjusted above after a test run in a B-29 flying laboratory. Developed by General Electric engineers, the device also registers air roughness and operation of the automatic pilot and de-icing equipment. It is scheduled for experimental installation in the planes of several commercial airlines to provide increased information on flight operations from take-off to landing.

Jato Boosts Skyrocket. A jet-assisted take-off sends the Navy's experimental Douglas D-558-2 aloft with a good start. Designed to explore flight at high speeds and high altitudes, the Skyrocket is powered by both jet and rockets. It climbs to high altitudes on its jet engines. The pilot then turns on rockets to approach the speed of sound. For landing, he switches back to jet power. The Jato bottles seen above attached to each side of the plane are dropped shortly after take-off.

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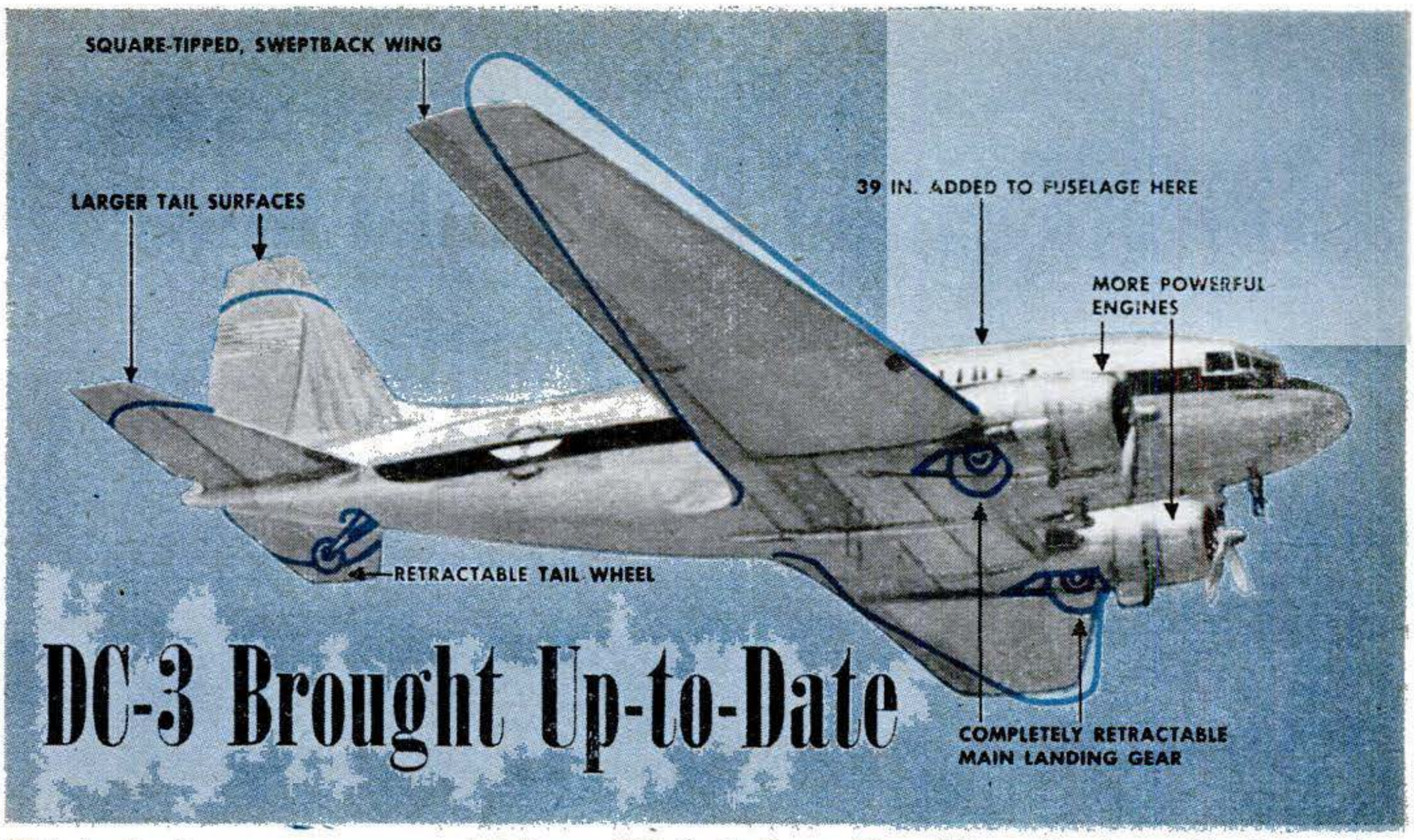
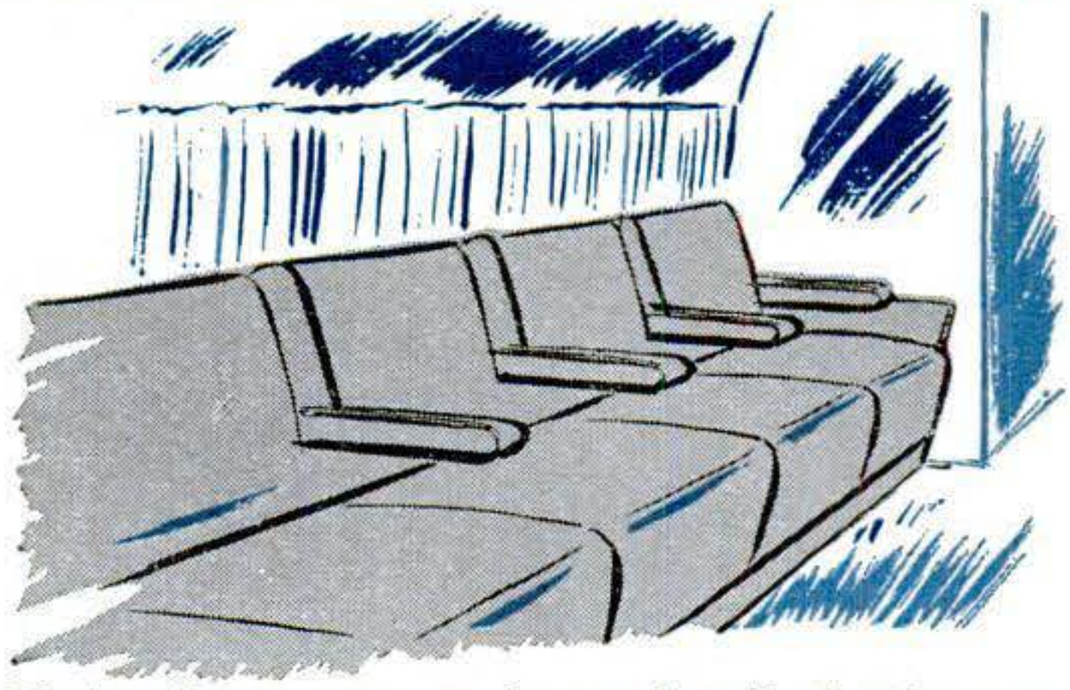


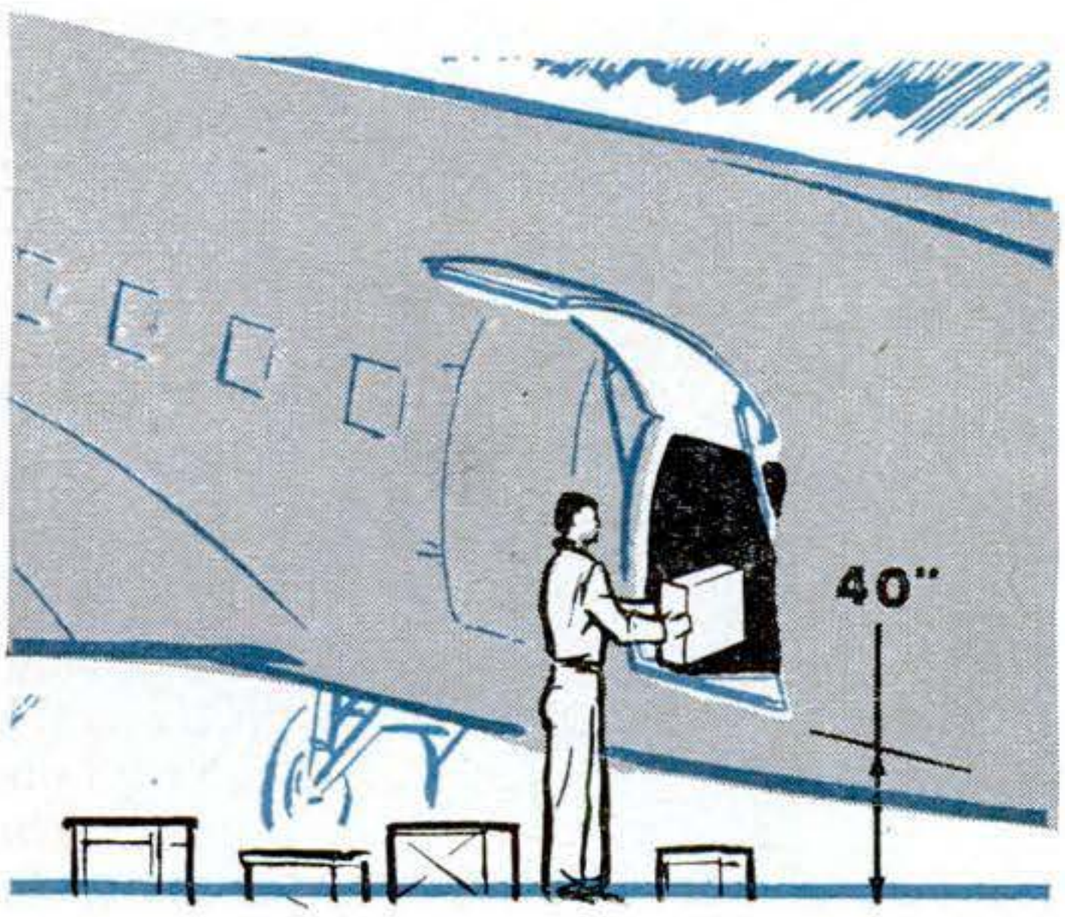
DC-3 Brought Up-to-Date

This is the faster, more powerful Super DC-3 air liner. The old version is outlined in color.

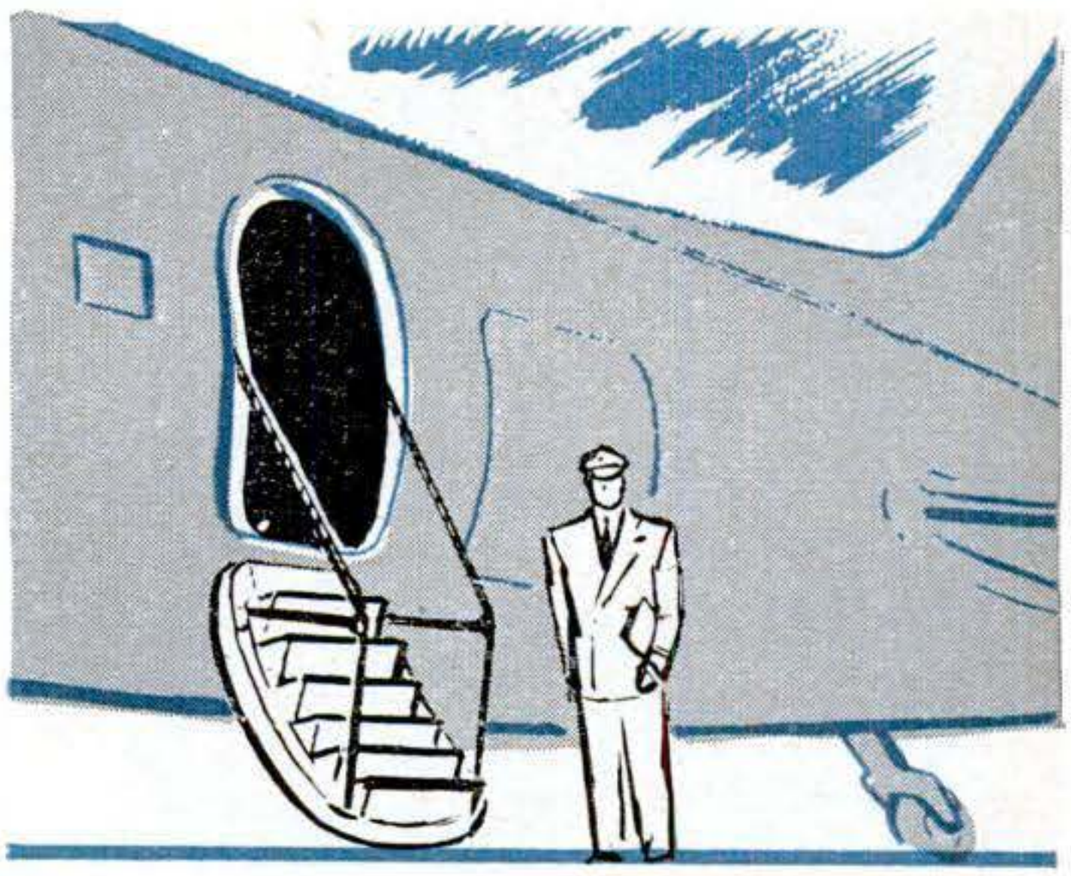
THE DC-3, famous old wheel horse of air transport, is getting a shiny new harness. The Douglas Aircraft Co. is offering civilian and military operators of some 6,000 of the twin-engine planes an overhaul from nose to tail. A choice of more powerful Wright or Pratt & Whitney engines will give the Super DC-3 a speed of 234 m.p.h., an increase of 45 m.p.h. A new take-off weight of 28,300 pounds, 3,000 pounds more than formerly, will boost passenger capacity from 21 to 31. Only outward differences will be 39 in. added to the fuselage, sweptback, square-tipped wings, and larger tail surfaces.



Eight divan seats in forward end of cabin, as shown above, are featured in 31-passenger version of revamped plane. Other seating arrangements accommodate 27 and 29 passengers.



Waist-level cargo door in the rear of the plane simplifies the handling of cargo and passenger luggage. Cargo door in the old version, located in the nose, is 10 feet off of the ground.



Built-in loading steps of the Super DC-3 do away with the cumbersome ramp that has to be rolled up to old plane at airports. This feature will save ground time at way-stations.

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Chrysler Adds a Crash Pad, Keeps Detachable Fenders

Company's entire '49 line, including Plymouth and DeSoto, stresses safety, economy, and maneuverability.

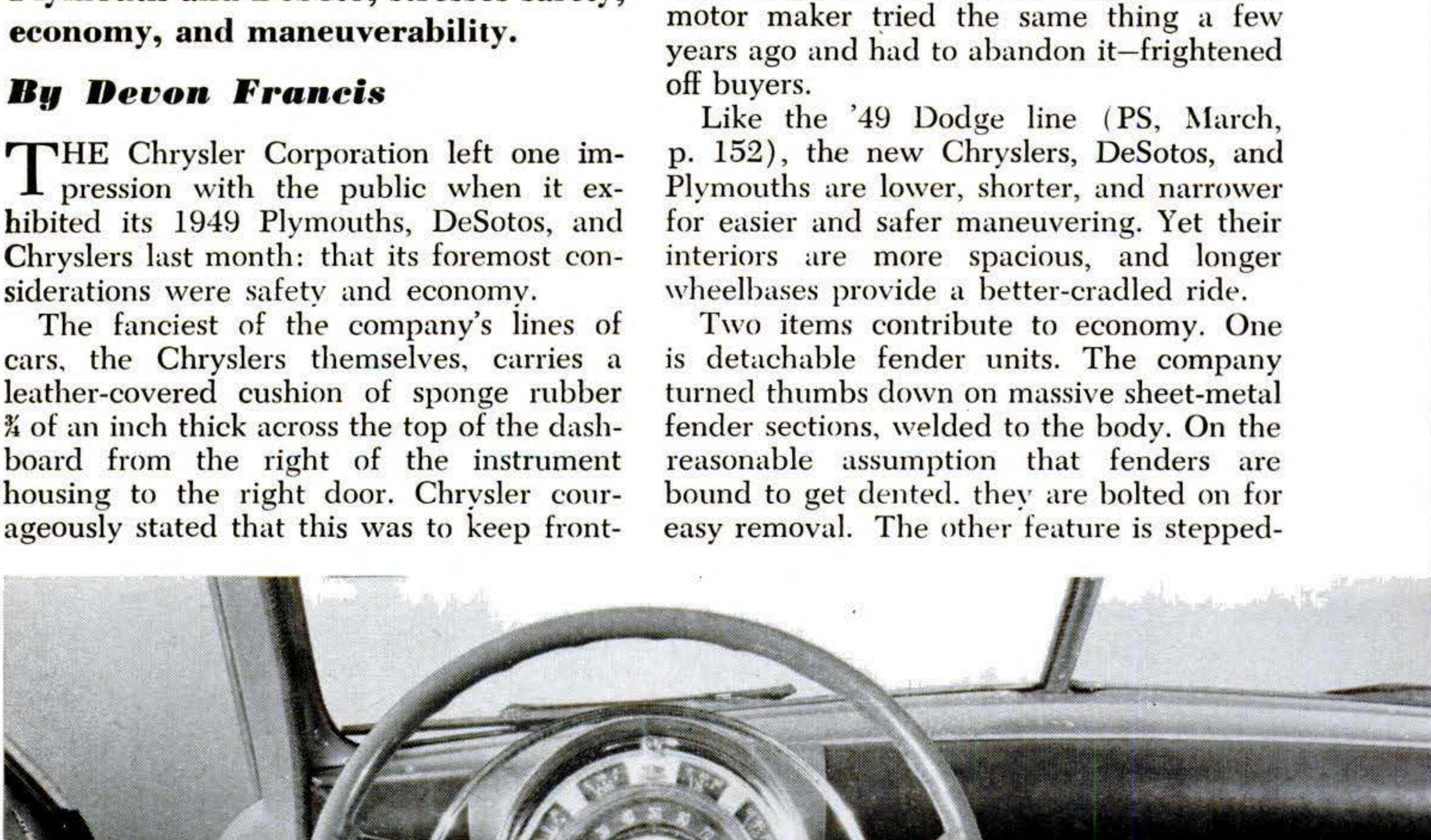
By Devon Francis

THE Chrysler Corporation left one impression with the public when it exhibited its 1949 Plymouths, DeSotos, and Chryslers last month: that its foremost considerations were safety and economy.

The fanciest of the company's lines of cars, the Chryslers themselves, carries a leather-covered cushion of sponge rubber ¾ of an inch thick across the top of the dashboard from the right of the instrument housing to the right door. Chrysler courageously stated that this was to keep front-seat passengers from collecting bumps on their noggins in sudden stops. Another motor maker tried the same thing a few years ago and had to abandon it—frightened off buyers.

Like the '49 Dodge line (PS, March, p. 152), the new Chryslers, DeSotos, and Plymouths are lower, shorter, and narrower for easier and safer maneuvering. Yet their interiors are more spacious, and longer wheelbases provide a better-cradled ride.

Two items contribute to economy. One is detachable fender units. The company turned thumbs down on massive sheet-metal fender sections, welded to the body. On the reasonable assumption that fenders are bound to get dented, they are bolted on for easy removal. The other feature is stepped-



Pad along top of dashboard of new Chrysler protects front-seat passengers from bumps in sudden stops. Instruments are grouped in semicircle over steering column. "Eyebrow" over instrument housing blocks reflection from windshield. Rotary switches replace push-pull type.

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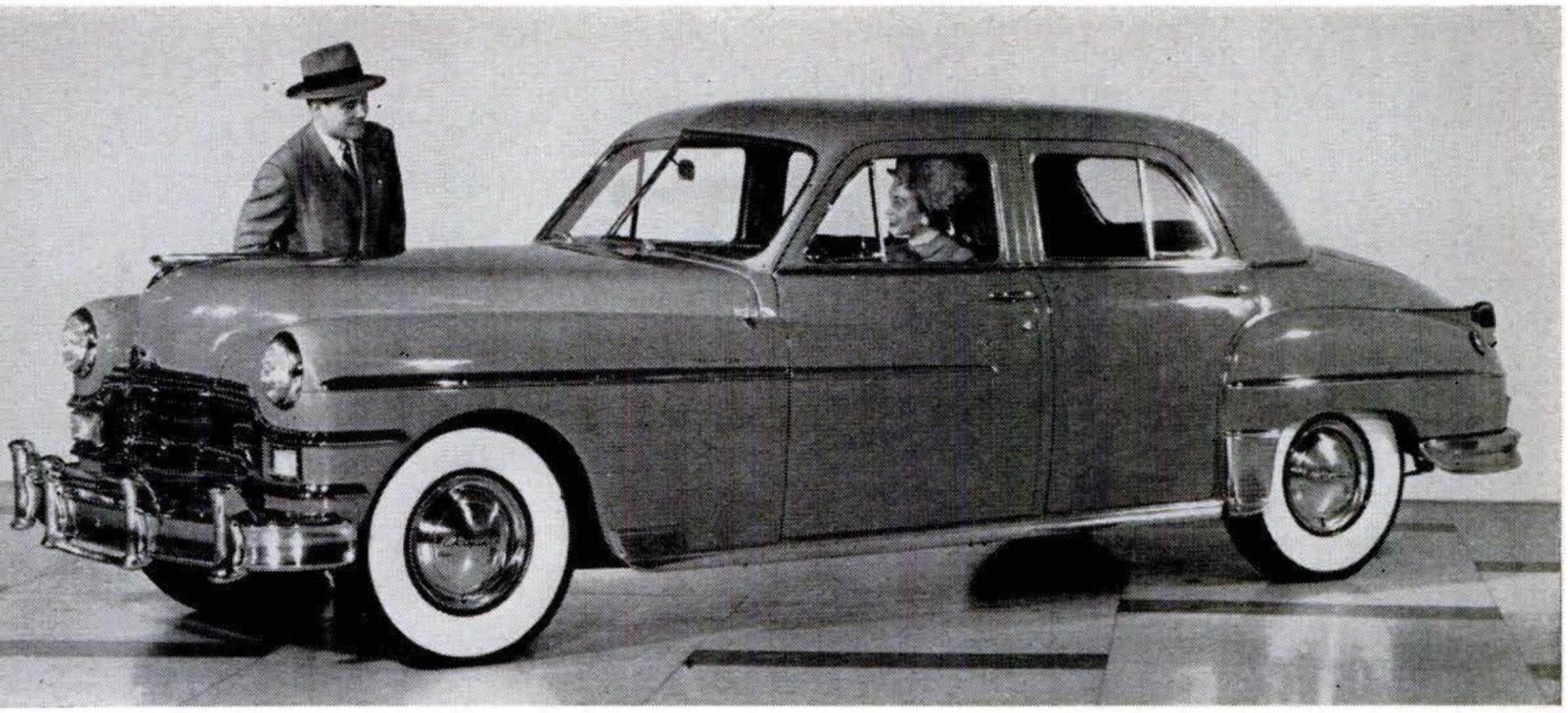


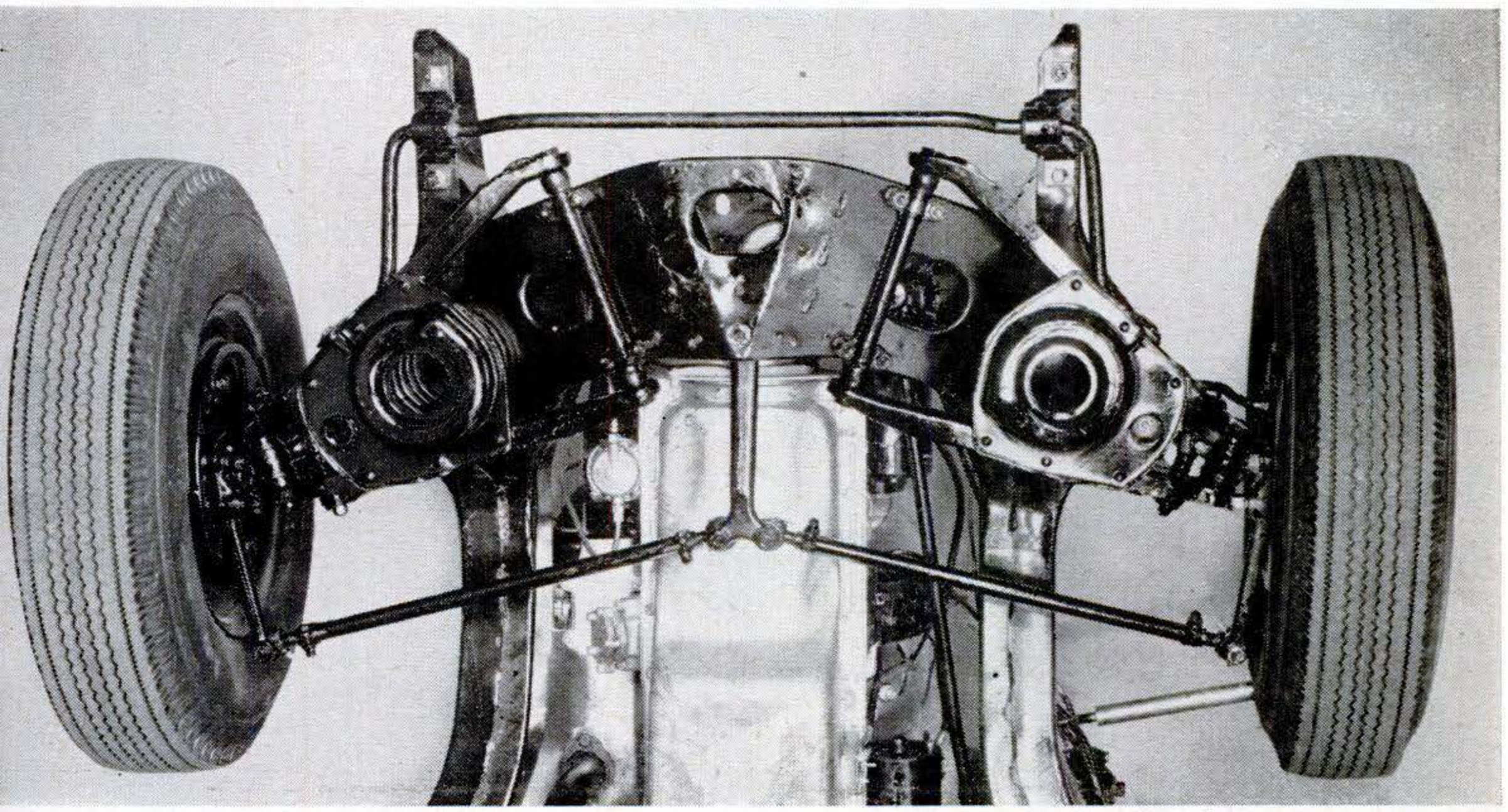
Wheelbase of this New Yorker® model is lengthened 4 in. to 131½ in., but car length is shrunk more than 4 in. to 210. Saratoga® has same measurements. Wheelbase of Royal® and Windsor® is 125½ in.; over-all length, 204 in. Cars are about 2 in. lower than last year's models.

up engine compressions for more mileage.

Recognizing theft danger, the new cars have heavily armored ignition wire under the dash to discourage short-circuiting.

The new Chryslers, called the Silver Anniversary® line, come in six groups and 22 body types with 6- or 8-cylinder engines. The Plymouth line has nine models: four Special Deluxe and two Deluxe types on a 118-in. wheelbase and three Deluxe types on a new 111-in. base.

DeSoto also has nine models. Its Carry-All® sedan has a rear seat that can be folded flush with the floor to provide extra luggage space. While less radical than the Kaiser Traveler® (p. 106), this model is another interesting departure from conventional practice aimed at greater utility.



Dead-center steering geometry prevents wind-wandering and wheel-fight in Chrysler. Static height of front springs is boosted from 9¾ in. to 11 in. Bodies have new door-sill construction that increases torsional rigidity 25 percent. Backup light is standard equipment.

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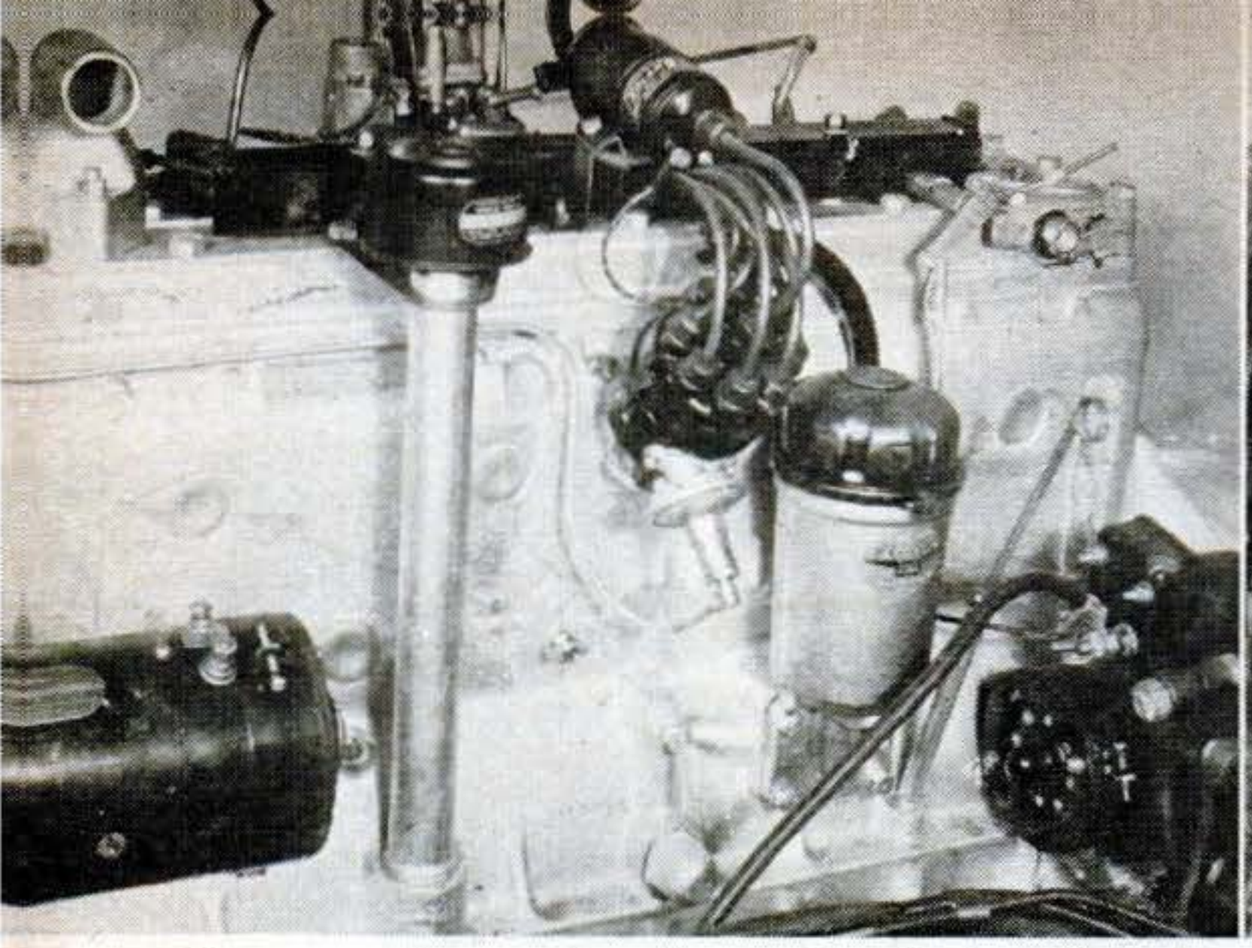
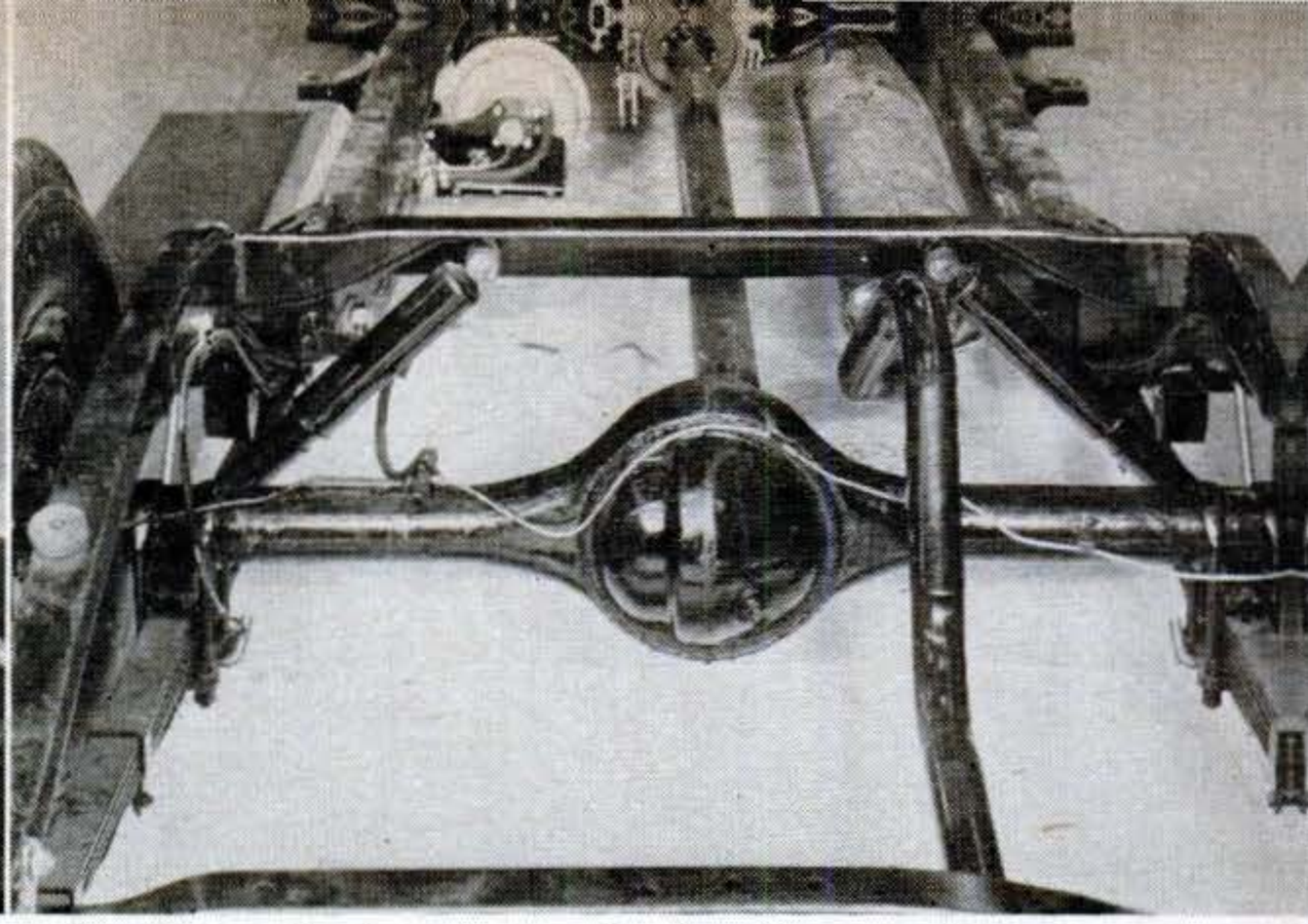
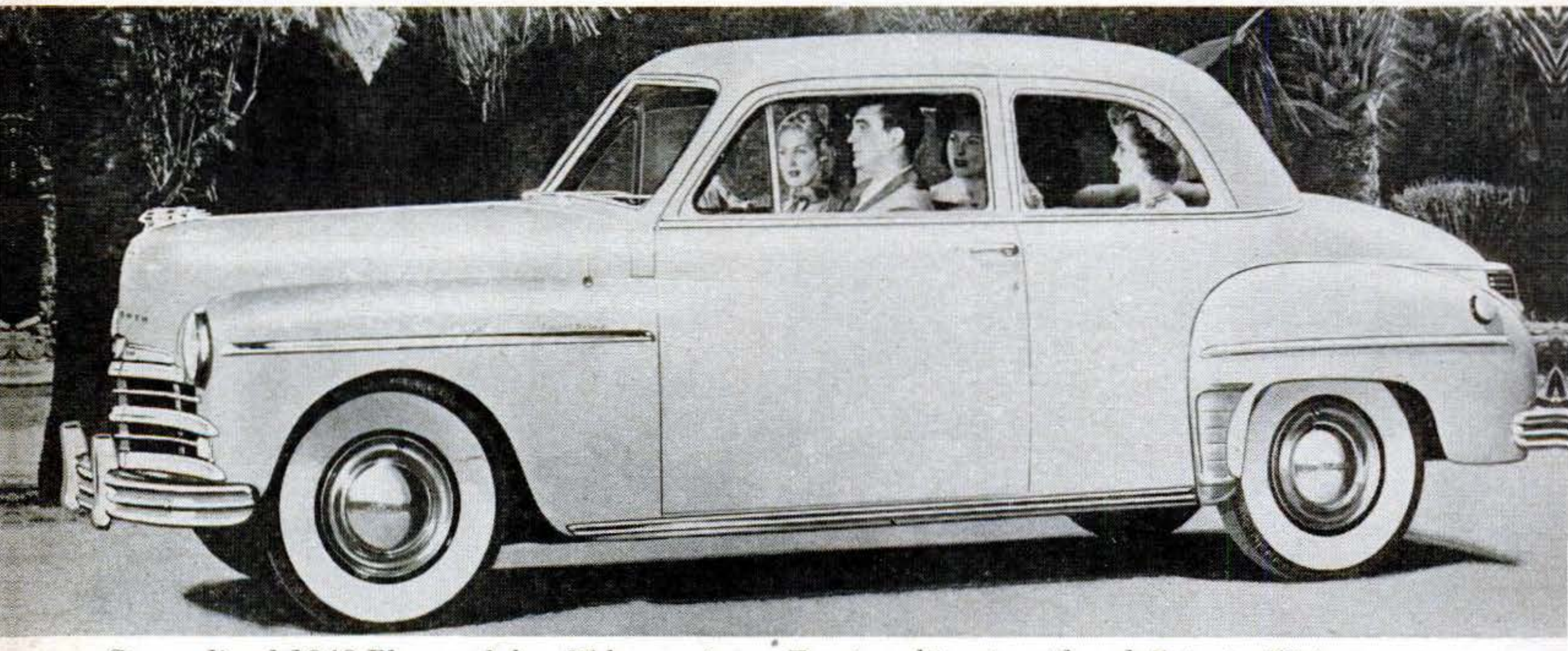


Compression ratio of new 6-cylinder Chrysler is increased from 6.7-to-1 to 7-1. Ratio in 8s is 7.25-to-1, same as Oldsmobile's. Resistors in plugs and distributor cut FM, TV interference.

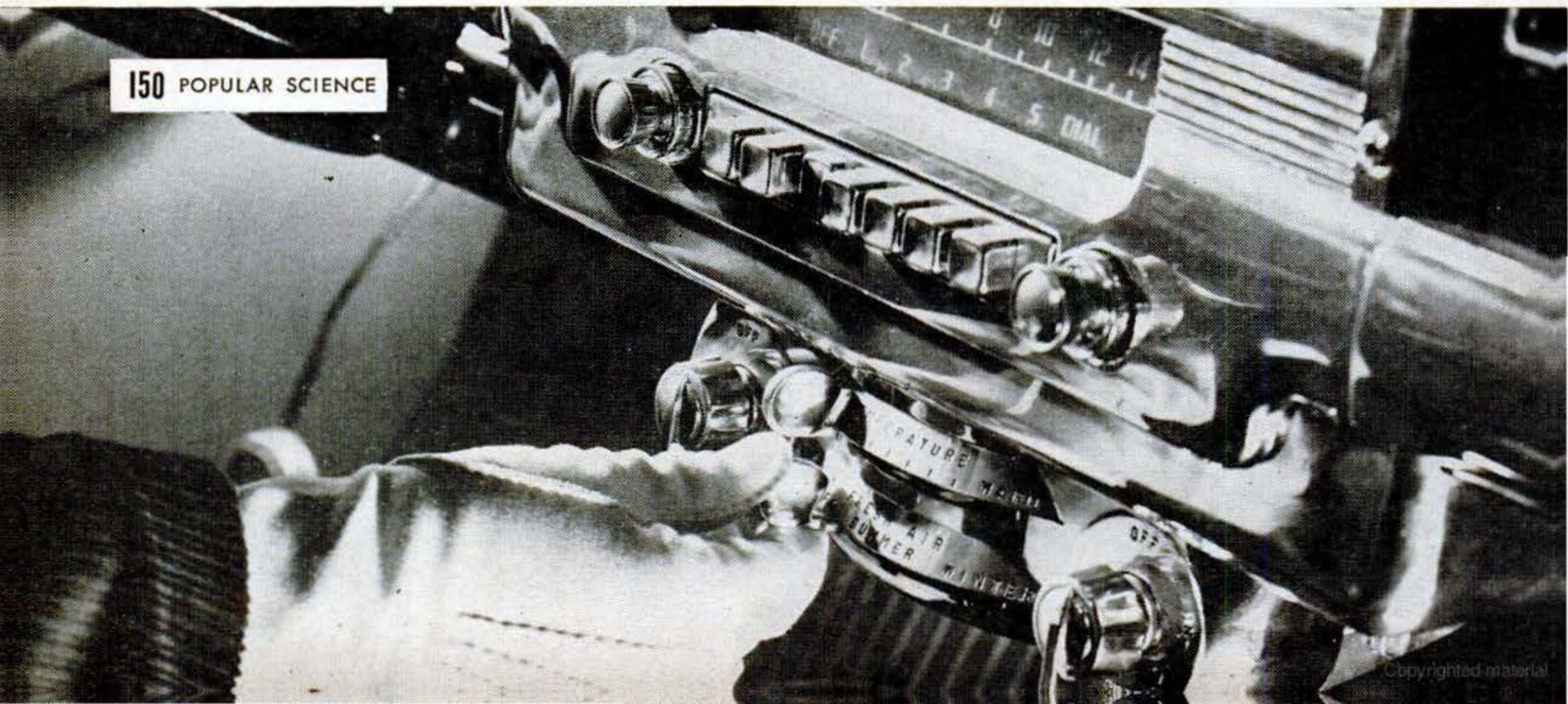


Rear shock absorbers of Chrysler are slanted inward from spring at axle to frame cross-member. They used to slant forward. Attaching shock to axle above spring increases road clearance.



Streamlined 1949 Plymouth has 97-hp. engine described as smoother, livelier, more economical. Compression ratio is boosted from 6.6-to-1 to 7-1. Chrome piston rings reduce cylinder wear. Front cushion is widened 5 in. to 56 in.; rear cushion, 6 in. to 57 in. Car has automatic choke. This view shows how fenders, while separate and detachable, blend into car's body lines.

Fresh-air heater in Plymouth steps up defrosting and removes window fog. In warm weather, it can be used as fresh-air circulator. Located under hood, heater has controls centered under dash (below). New cars' windshields and rear windows are more than a third bigger. Wipers clear much larger area. Both the front and rear seats have three-pillow cushions.



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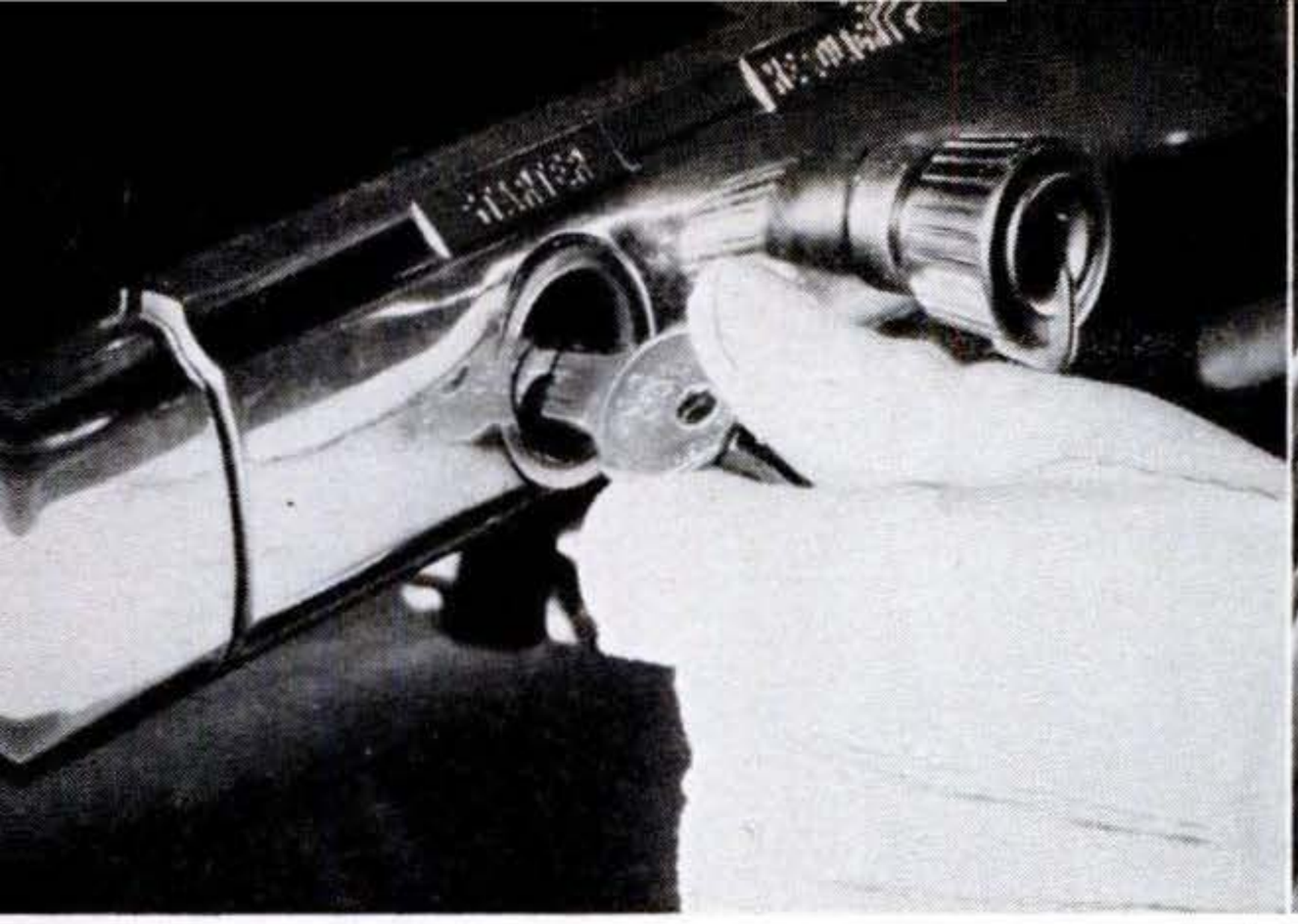
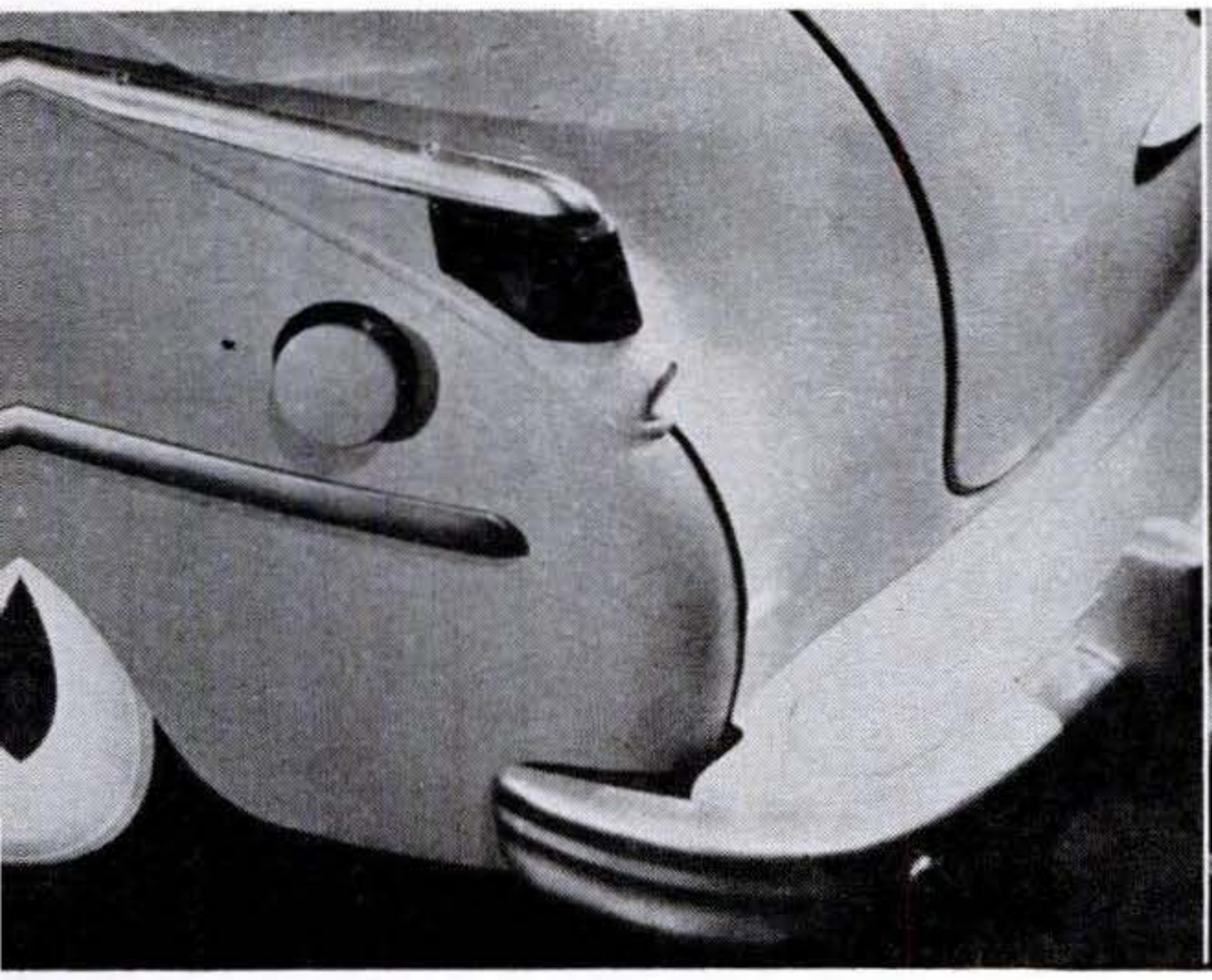


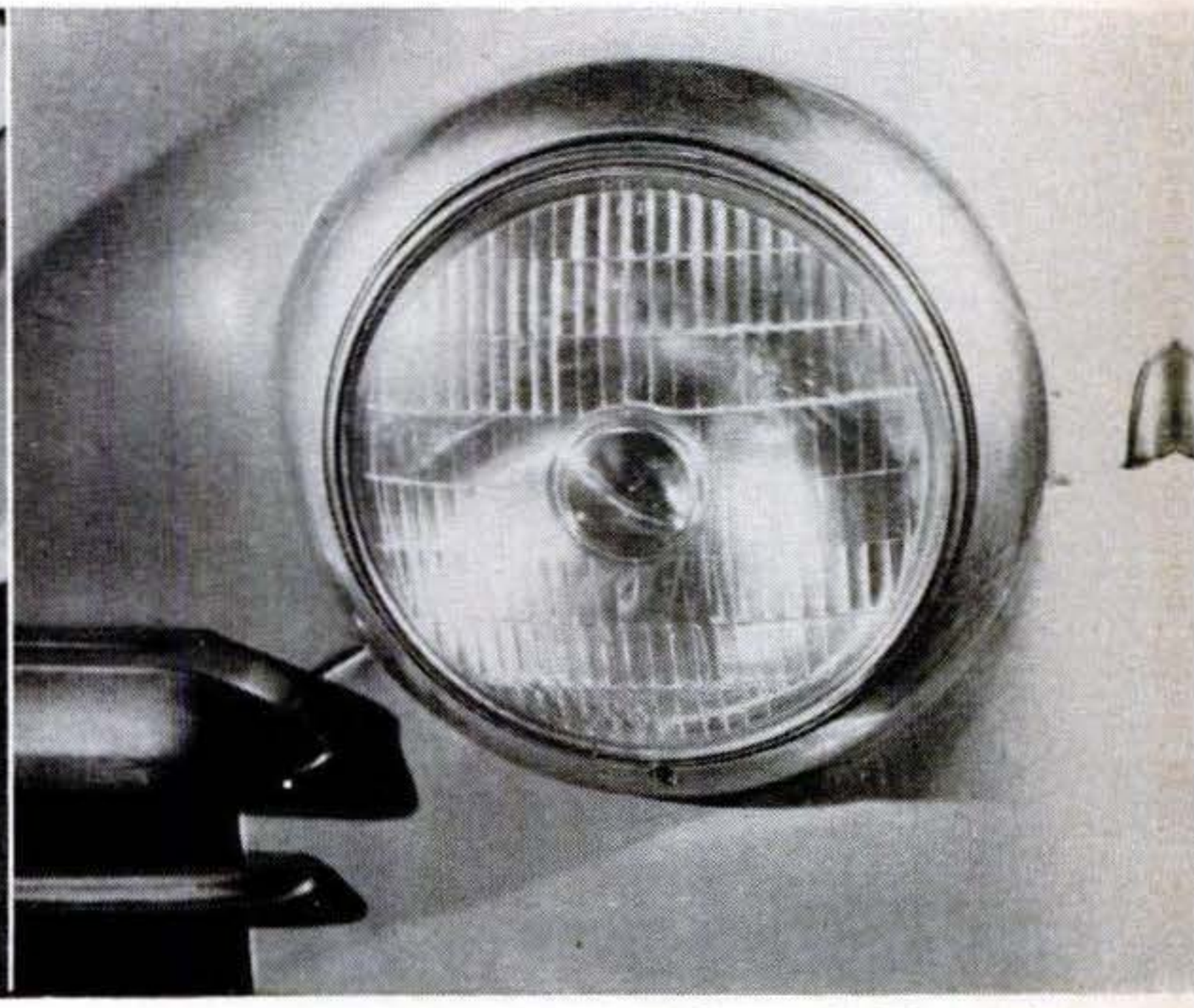
Combination switch for ignition and starter eliminates starter button on new Chryslers, Plymouths, and DeSotos. Engine starts when key is turned slightly beyond "ignition on" position.

To reduce theft from parked cars, models of all three Chrysler divisions have button that locks vent window. Plymouth windows open and close with half the handle turns formerly required.



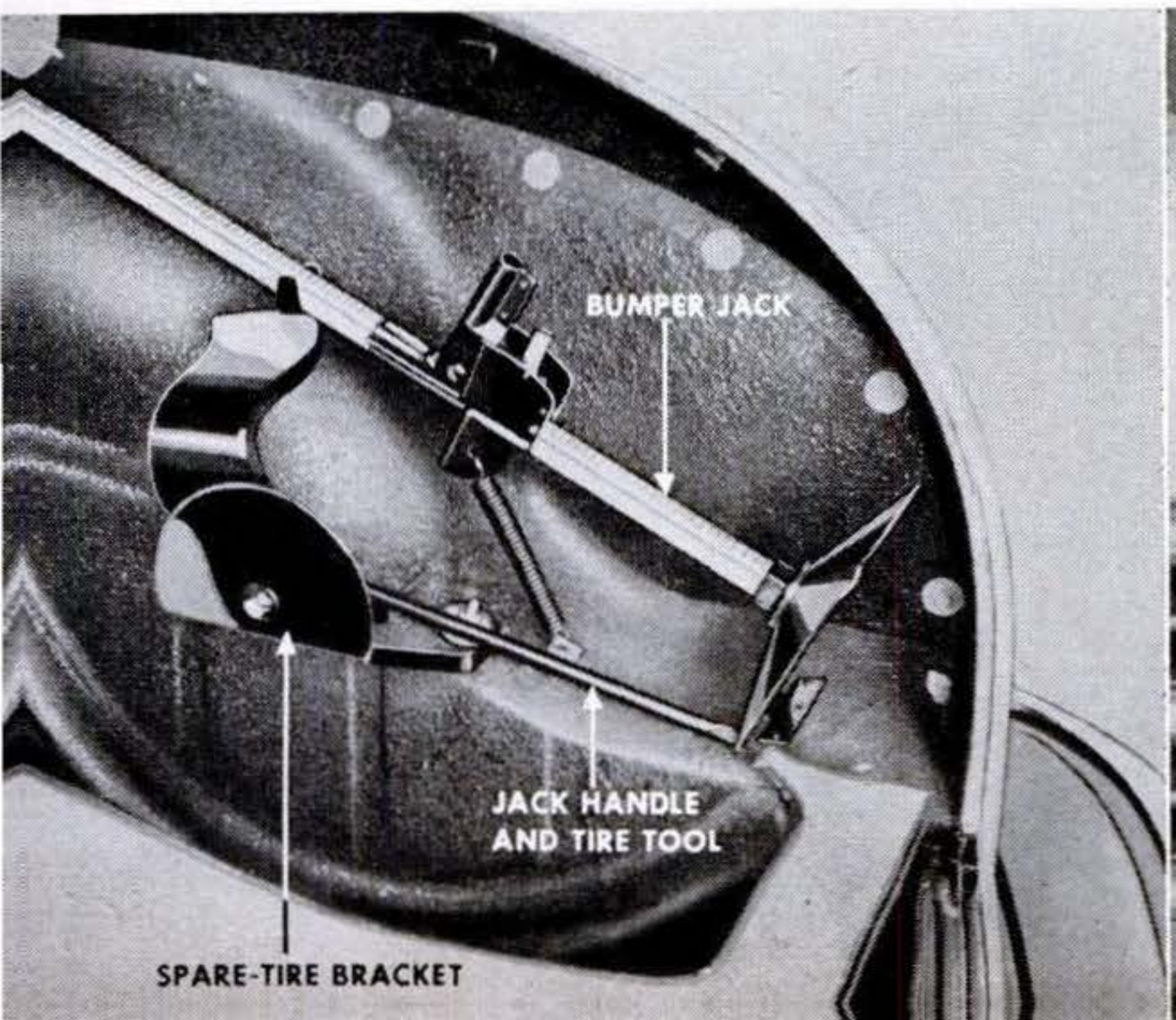
Plastic lens on Plymouth tail light increases brightness by transmitting light through entire surface. Also on stop and parking lights, plastic resists breakage and gives better dust seal.

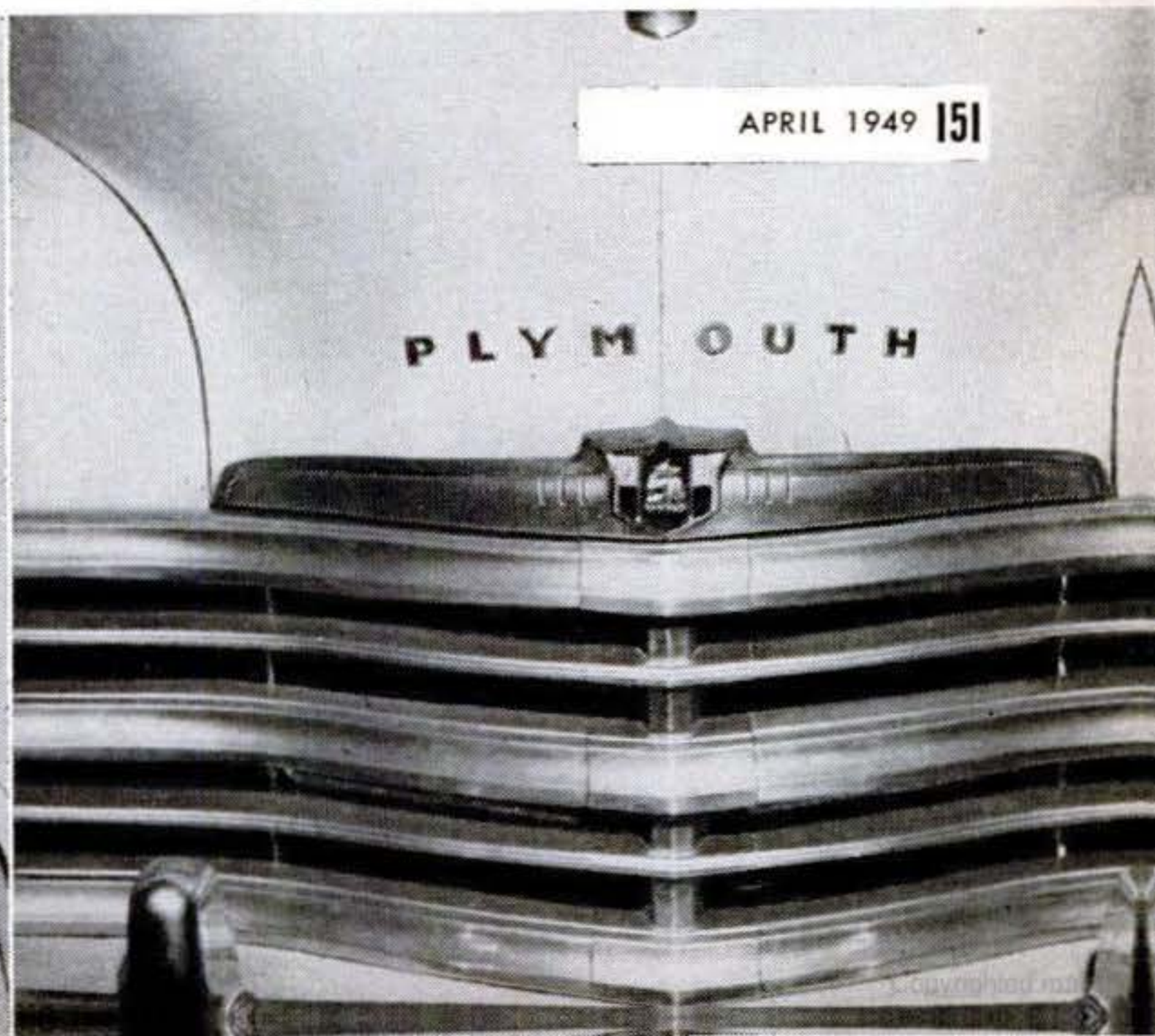
Rack for bumper jack keeps it from rattling around Plymouth trunk compartment. Spare fits on bracket against rack. Like new Chrysler and DeSoto, car has diagonally mounted shocks.

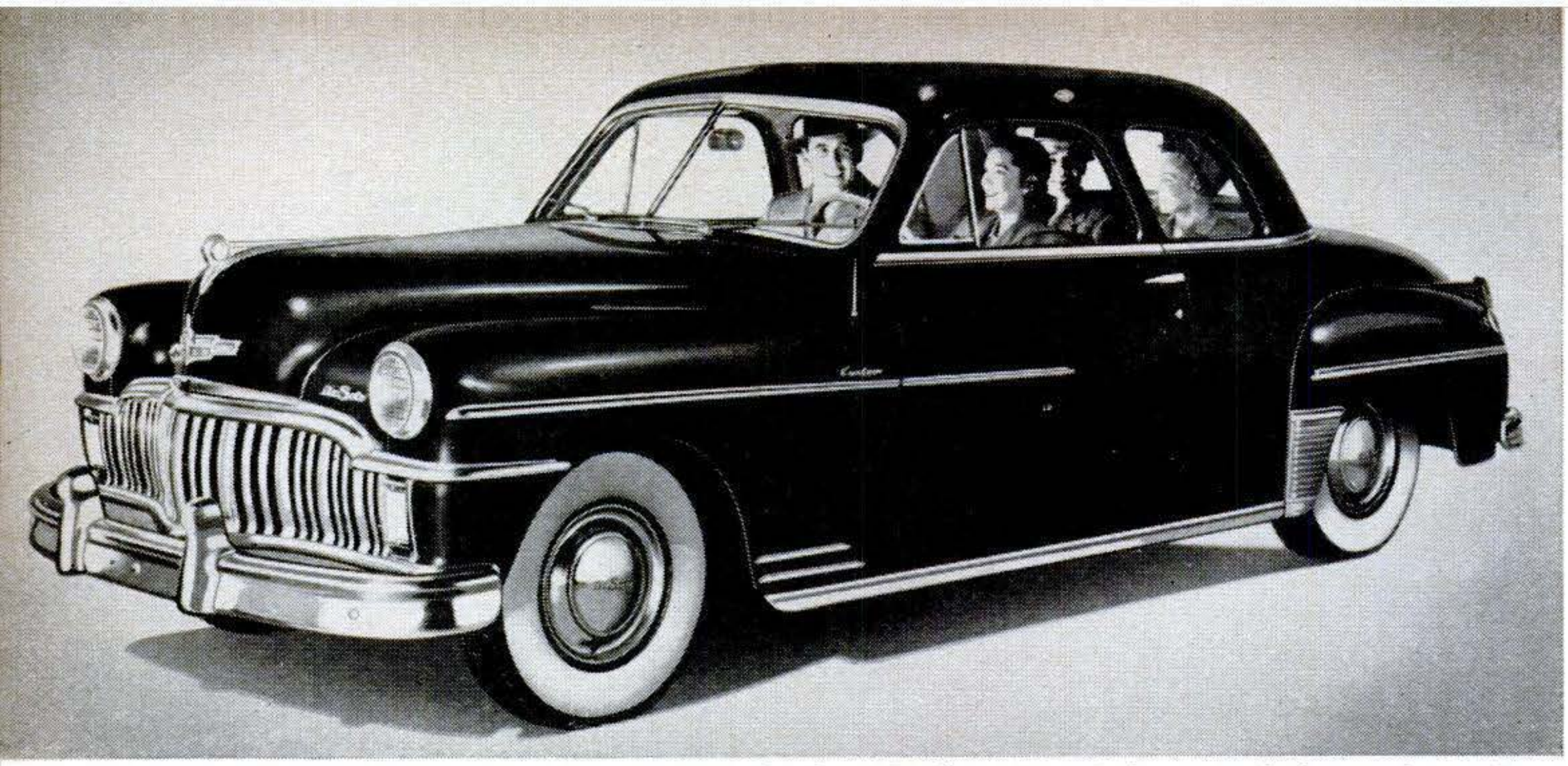


Bull's-eye lens in the center of the sealed-beam lens increases the output of light from headlights. Enclosed circuit breaker in all of Chrysler lines eliminates need to replace lighting fuses.

Styling changes in Plymouth are on conservative side—"common-sense streamlining." Sedans have rear door hinged from center post to prevent swinging open if unlatched accidentally.







DeSoto's Custom Club coupe is typical of models in 1949 line of this Chrysler division. Steering effort is reduced by use of "reverse casters," imparting a "leading" action to front wheels. Gear-shift control levers have been lengthened. Filter, gasket, and sediment bowl are eliminated from fuel pump. DeSotos have an 125½-in. wheelbase, an increase of 4 inches.

Girl Builds Cloud Chamber for Physics Lab

WHAT attracts a college girl? In the case of Joan Hinton, pretty sophomore at Bennington College, it was the electrically charged particles of nuclear physics. Result: her own version of a cloud chamber, the device with which scientists "see" sub-atomic projectiles by observing their tracks.

Miss Hinton's cloud chamber consists of two compartments separated vertically by a rubber diaphragm. Compressed air, valved into both, builds up a pressure of 7 lb. in the upper compartment and 9 lb. in the lower, so the diaphragm bulges upward.

Pressing a switch then trips a pair of solenoids that open a valve and release air from the lower compartment. This lets the air in the upper compartment expand against the diaphragm. As the air cools from expansion, it can hold less water vapor. And the excess vapor condenses into fog on a string of air molecules ionized by particles shooting from a radioactive needle.

Physics students operate cloud chamber (left) built by college mate. Atomic bullets shoot from needle in glass cage above. Black velvet over rubber bottom aids photographing tracks.

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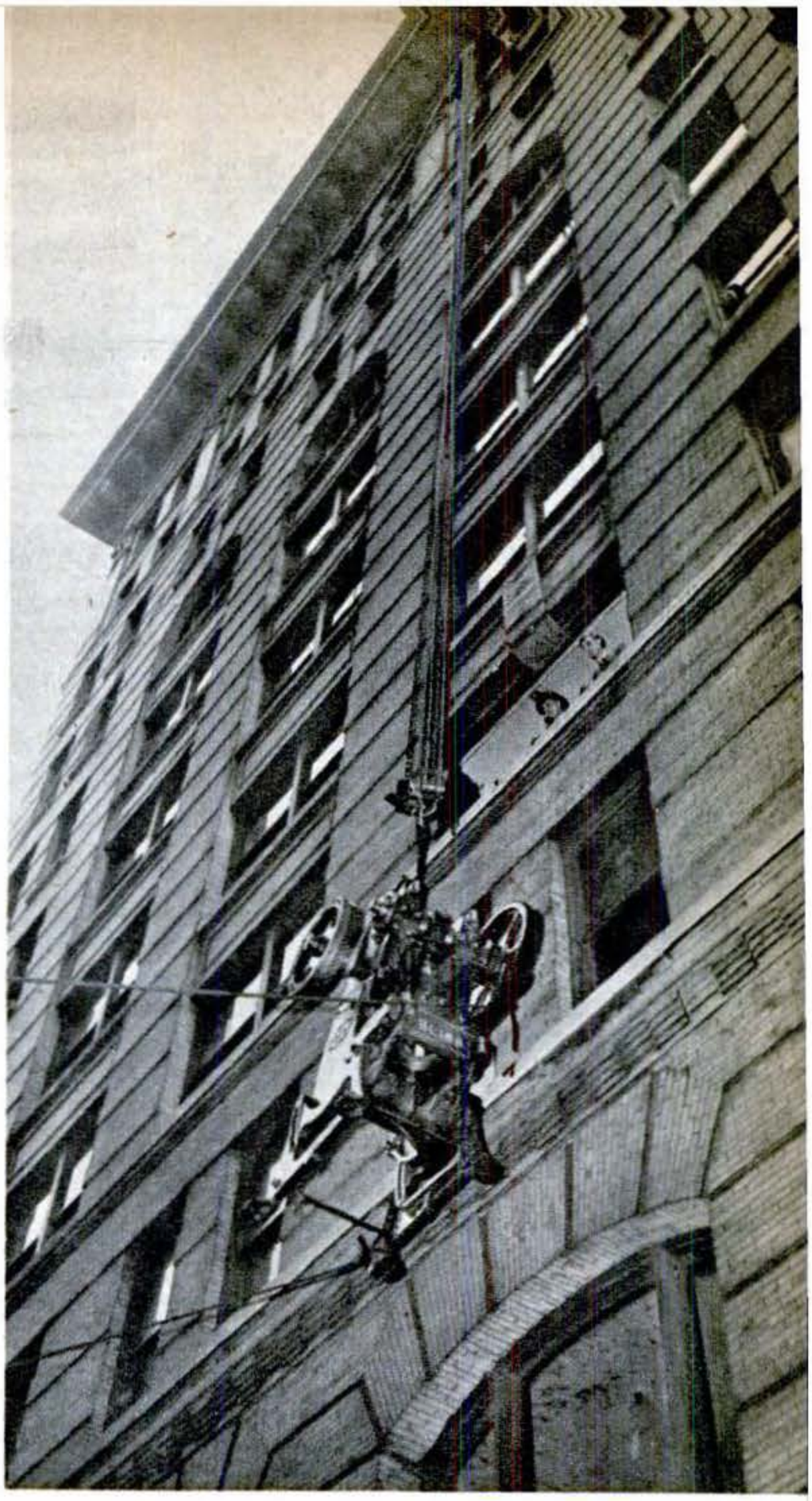
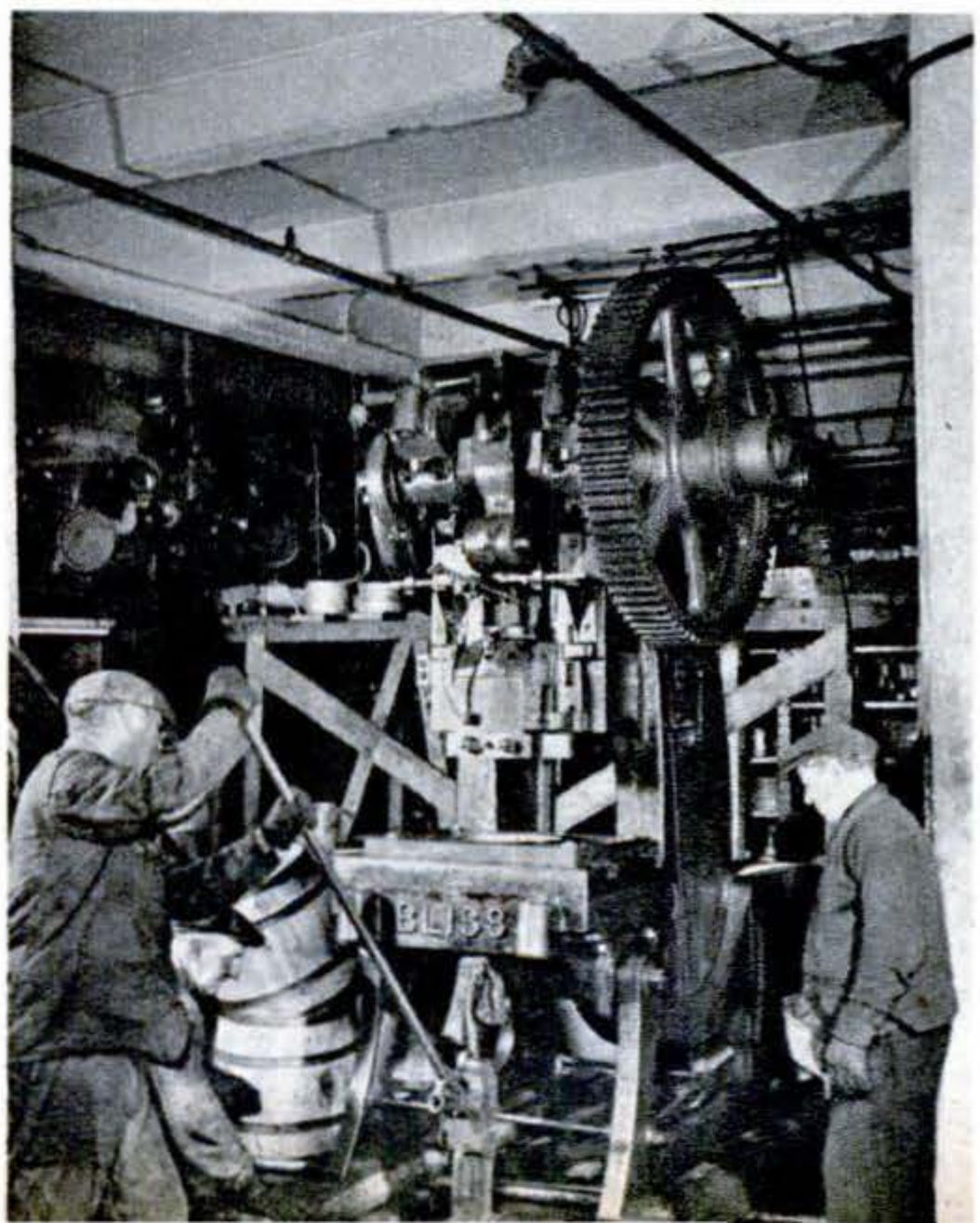
How Experts Move Big Stuff

Riggers' tricks in lowering a 10-ton press from the 4th floor of a factory offer tips for farmers and mechanics.

PS photos by Hubert Luckett



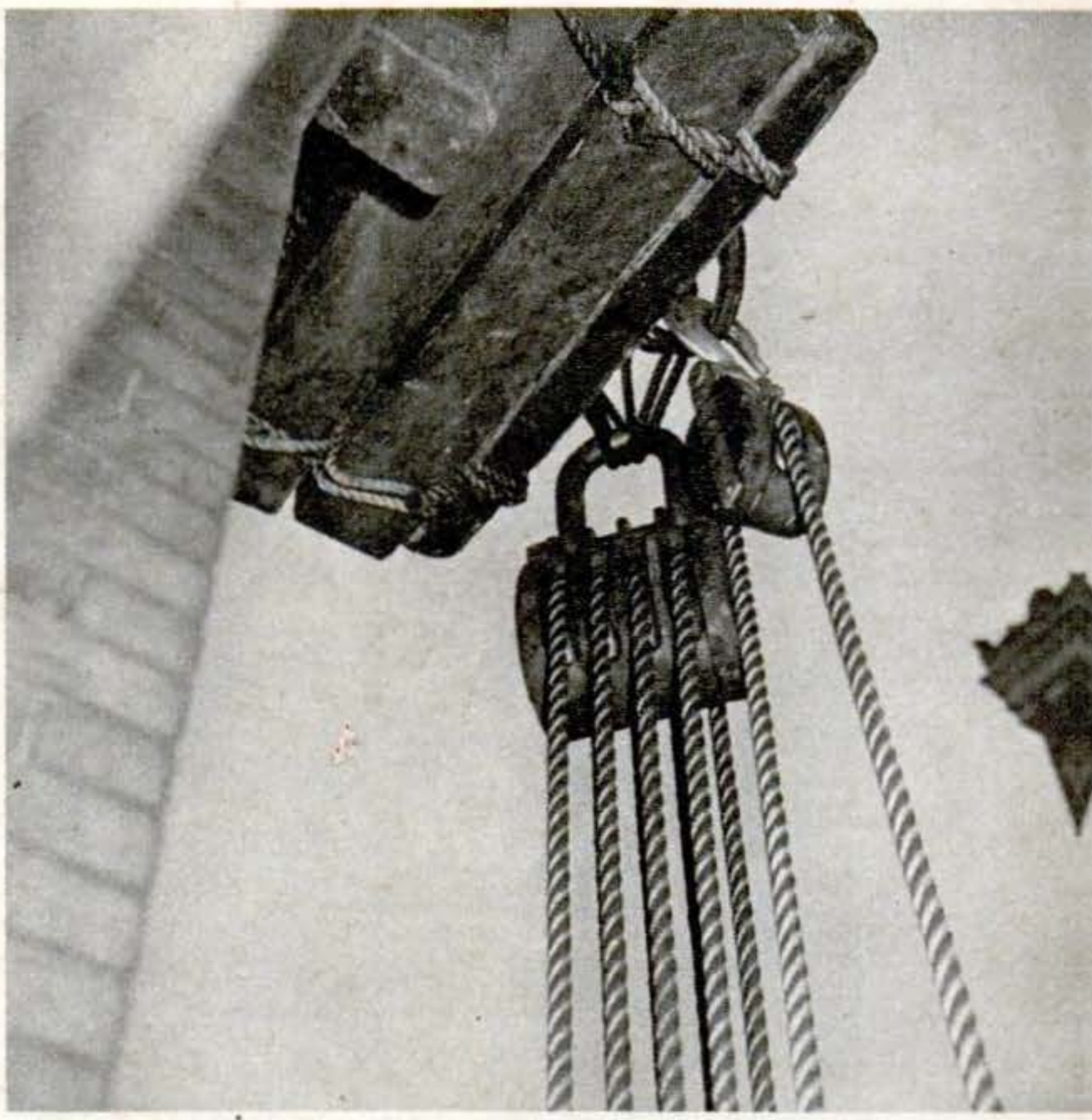
1. Machine is lifted with aid of jack (below), after spikes holding it to floor have been removed, and pipe rollers are slipped underneath. Note that the skids are left on the machine.



2. This press is too heavy to be pushed to the window, so must be dragged with block. One way of fastening hook to machine is with sling (below), a short cable with loops at each end.

3. One man can exert about 2,000 pounds of force with this type of block. When the press reaches the block, it will have to be turned around the corner and moved in a new direction.

4. This geared chain block does the work. It operates in either direction and uses a worm drive to prevent slipping. It is not bolted to the floor but is lashed to a pillar of the building.



7. The 10-ton load will be supported outside the building by a big block fastened to these timbers, which distribute the weight across four steel columns in the building wall itself.

8. This four-fall block, set at the 11th floor, lets the press ride slowly down from the fourth floor to the street. It is lashed to timbers that in turn are tied to those in picture 7.

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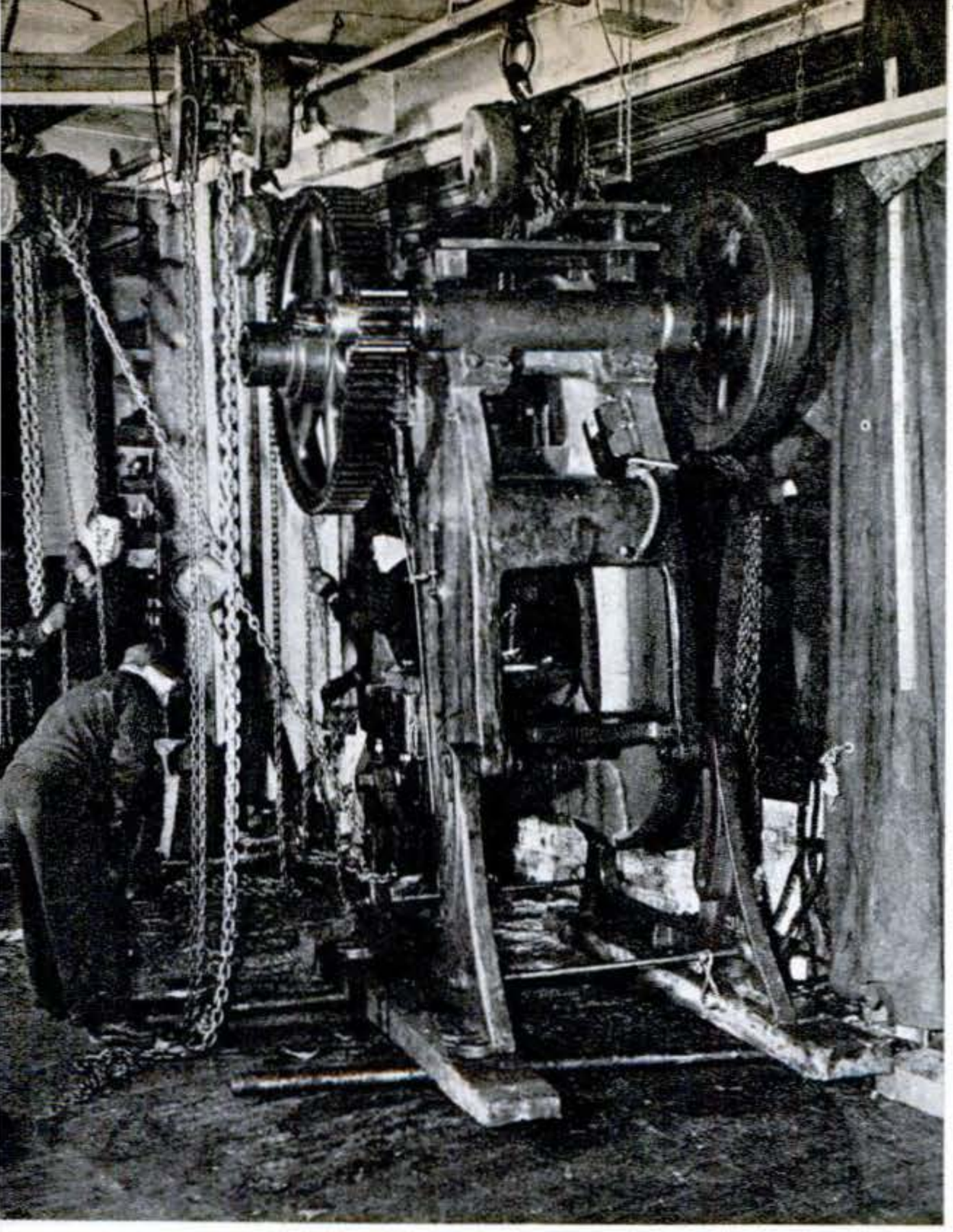
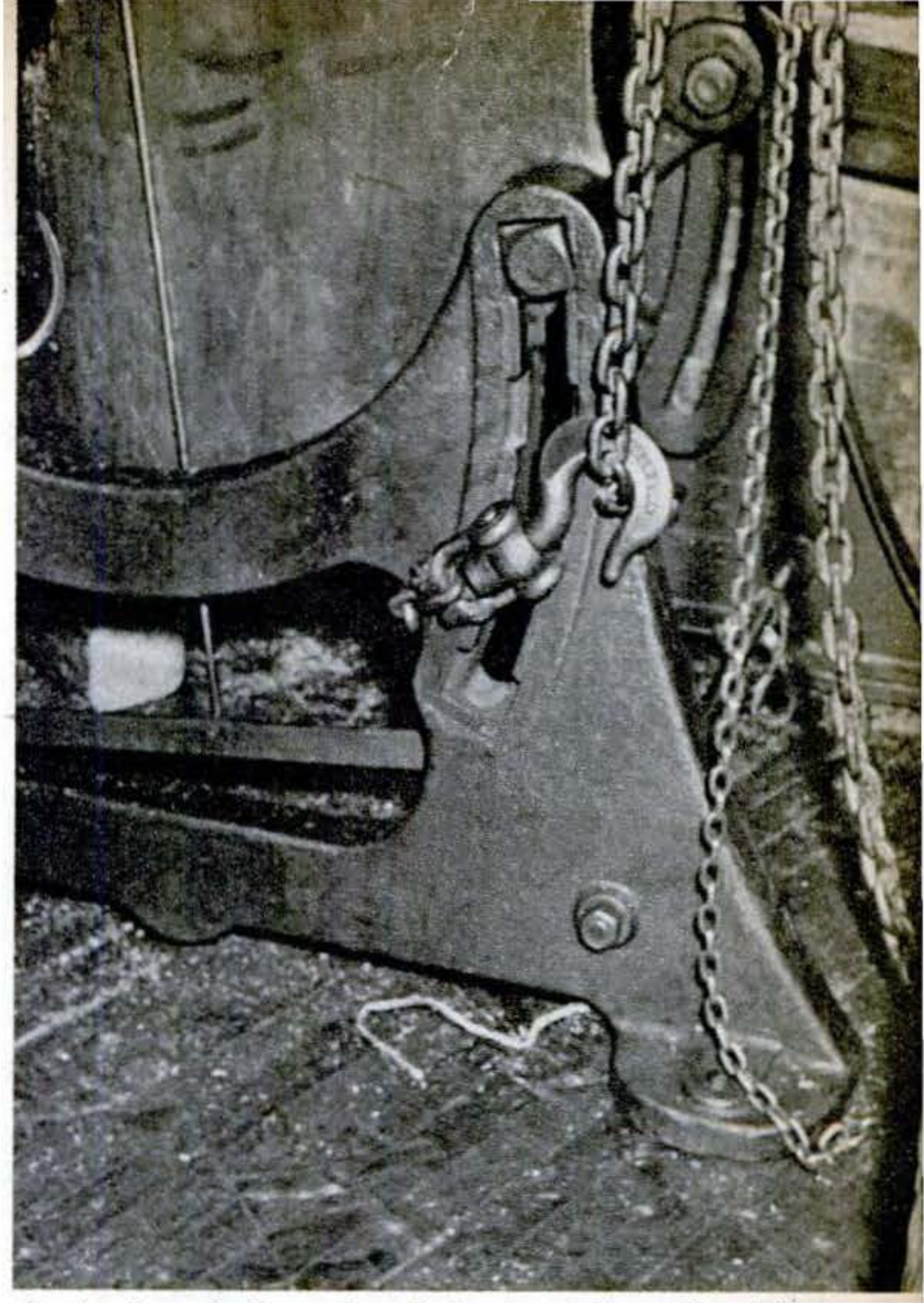
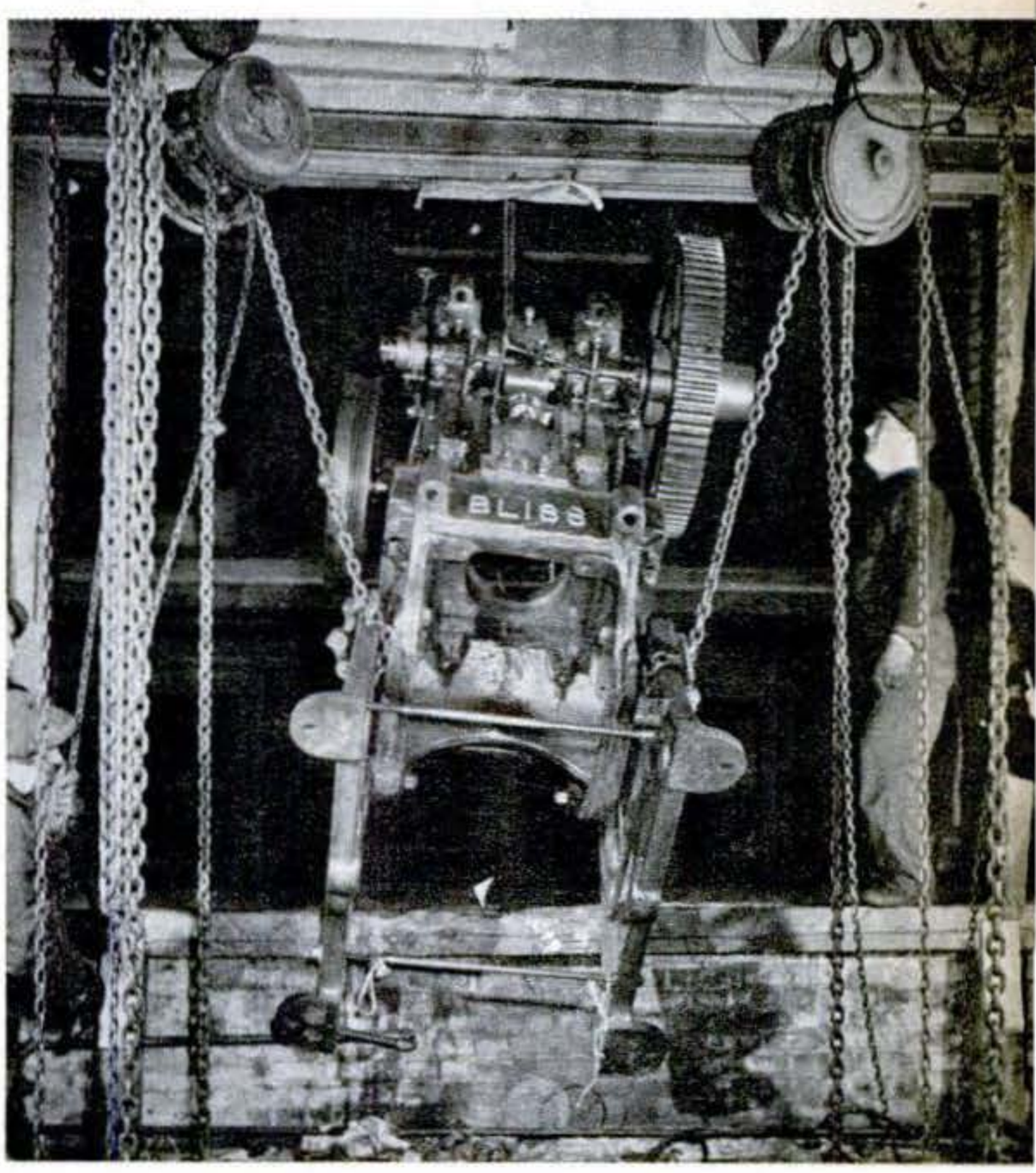


5. Blocks at window, strapped to ceiling I beams, pull press into final position. These blocks are set at the corners of a square, so that the press can easily be swung into any angle.



6. At the window, the chains are adjusted to lift the press up and out of the building. In this case the chains are simply looped around part of the press and hooked to themselves.

9. A traveling block is tied to the press. The four sheaves in this and the 11th-floor block give a nine-to-one advantage, so that rope and capstan support only one-ninth of the total weight.



10. Most delicate operation is getting press, which is taller than the height of the window, outside the building. It must be lifted, tilted, and then swung out without damage.

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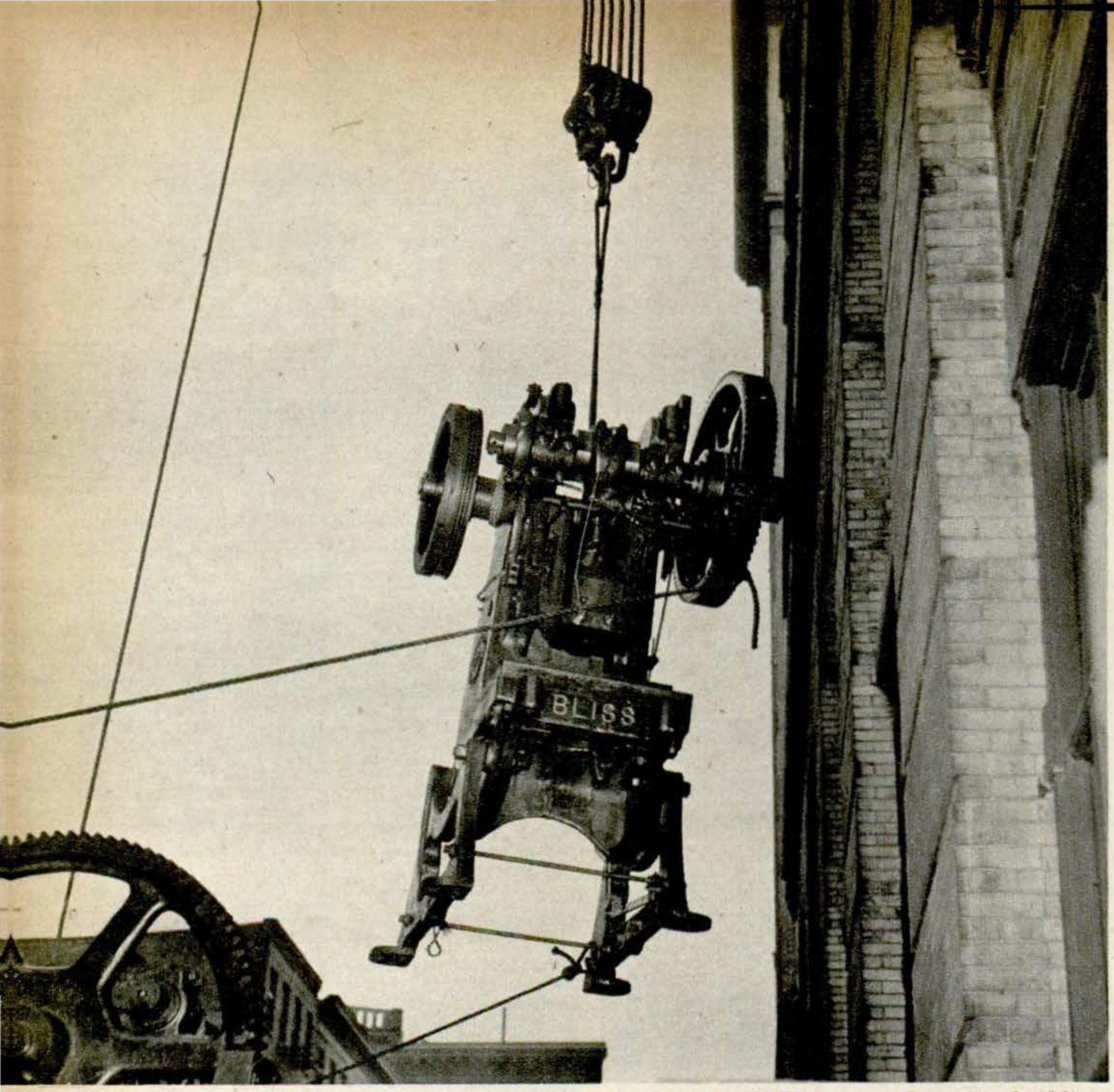
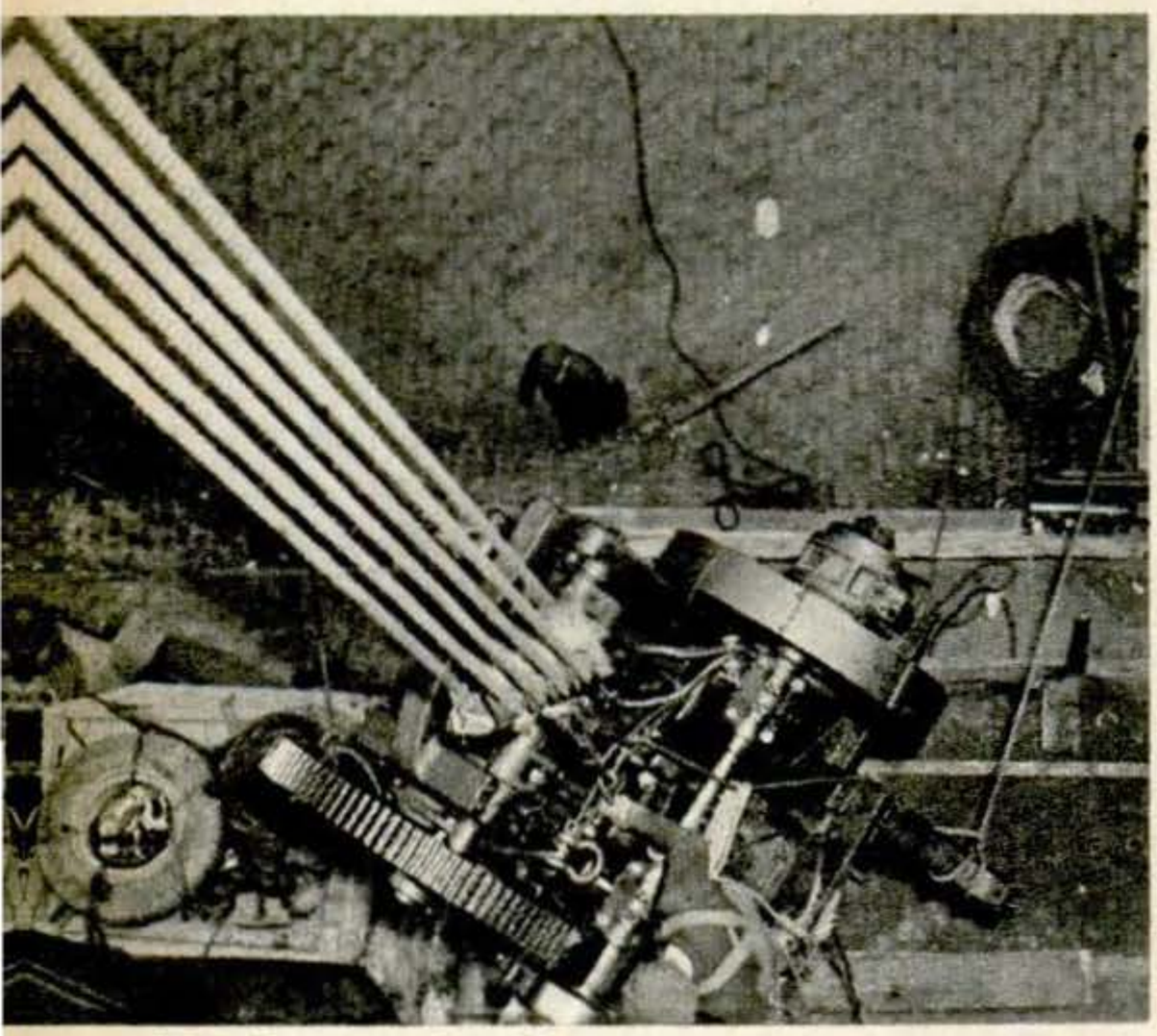


11. As the four-fall block lets the press down, guide ropes hold it away from the building.



12. Getting this 10-ton press to street was only part of Centre Trucking Co.'s job. It moved all the big machinery of the Colonial Metal Stamping and Spinning Co. in New York.

13. Capstan operator slowly pays out his rope, setting press gently down on trailer at right. It will then be lashed into place, all ready for trip to company's new plant in Brooklyn.

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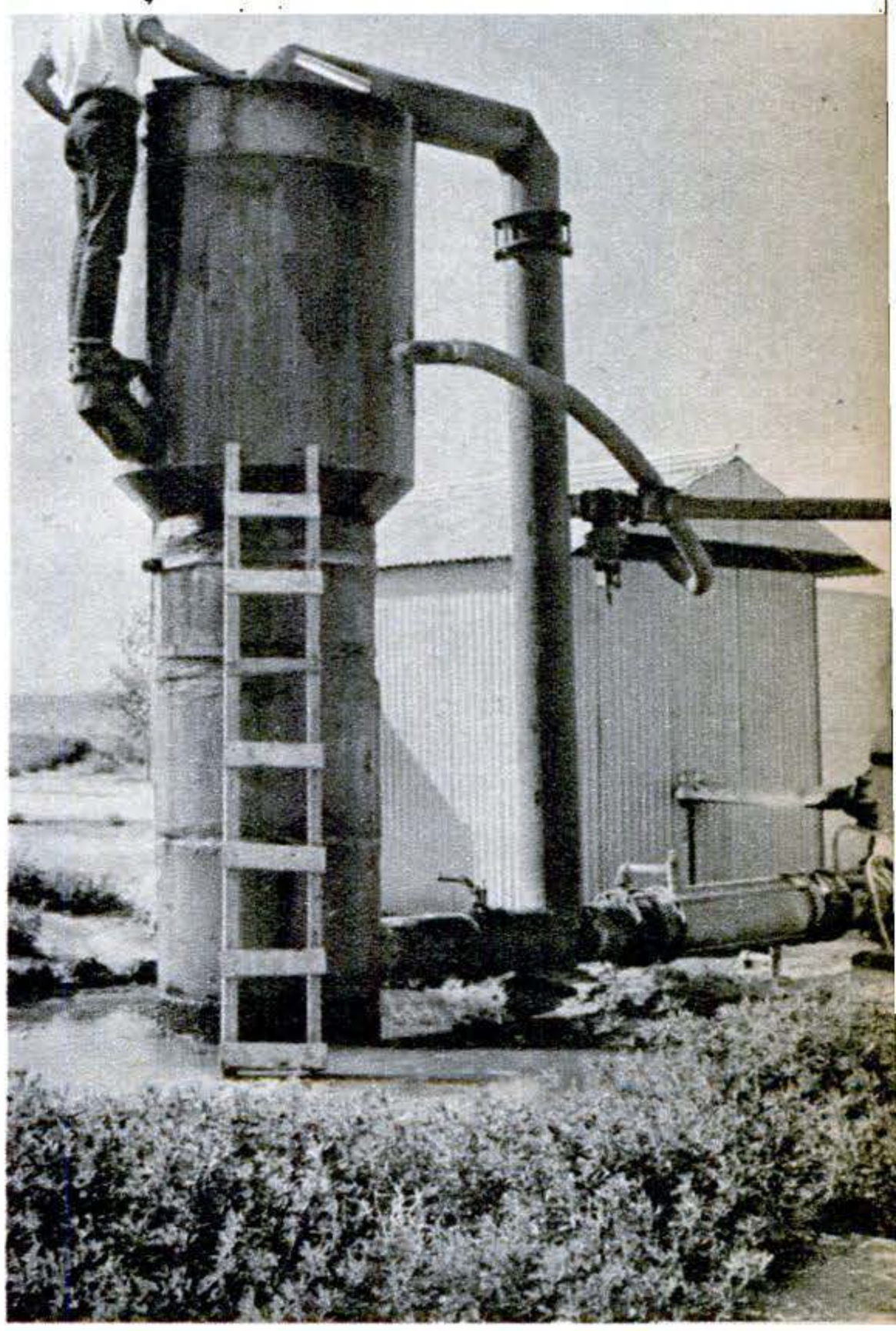
Waste Gas Turns Desert Into Garden

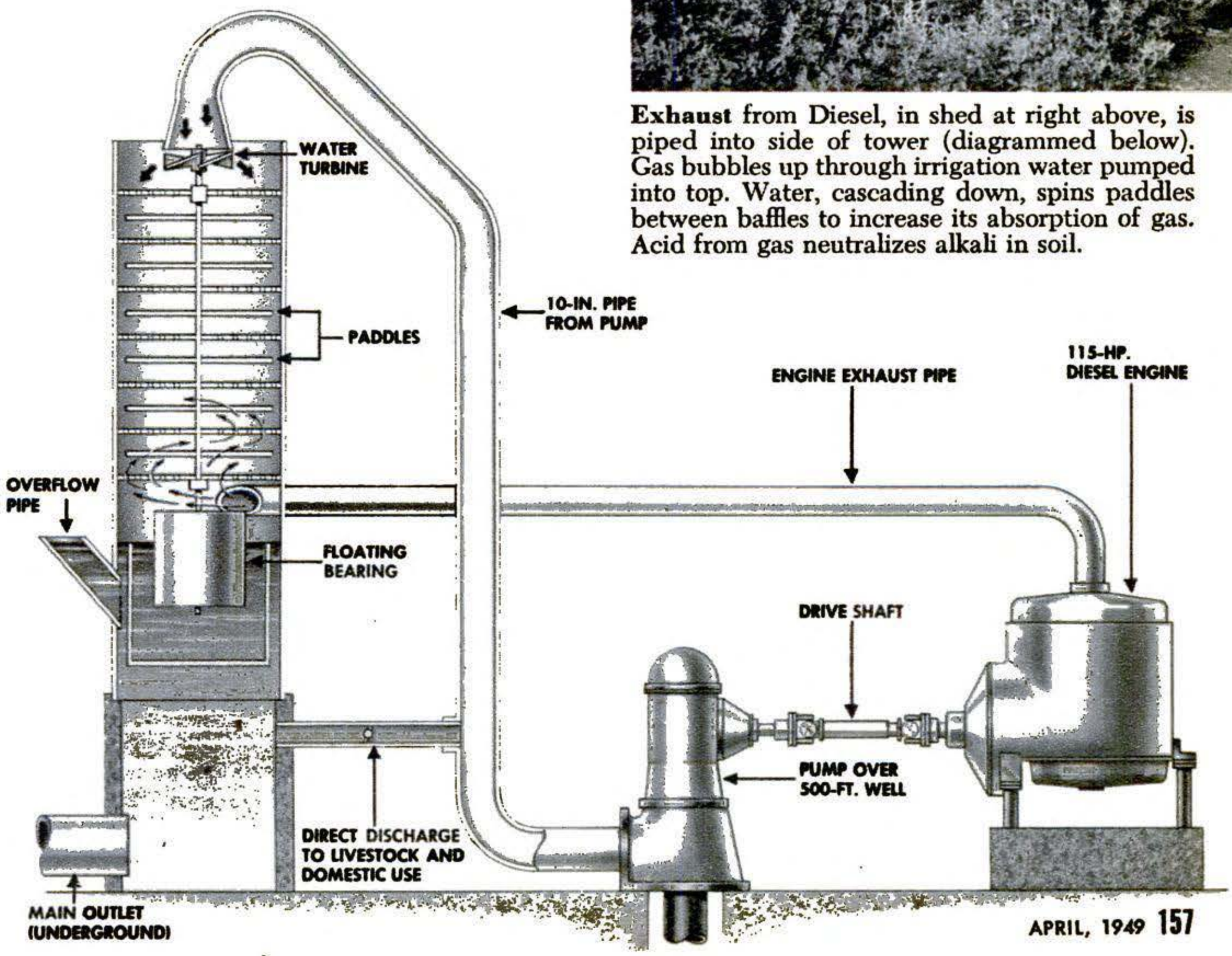
AN ARIZONA farmer, annoyed by the noise of a Diesel engine he was using to pump water for irrigation, tried putting a muffler on it simply by sticking the exhaust pipe into the stream flowing from his well.

This not only quieted the engine—but, somehow, greatly boosted the crop yield. An inquisitive Diesel engineer finally figured out why: acid from the exhaust gas, absorbed by the water, fertilized the soil by neutralizing some of its excess alkali.

Now the engineer, Carl Sues, of Lancaster, Calif., has put his discovery to work. He is growing alfalfa in the Mojave Desert with the help of the apparatus shown here.



Exhaust from Diesel, in shed at right above, is piped into side of tower (diagrammed below). Gas bubbles up through irrigation water pumped into top. Water, cascading down, spins paddles between baffles to increase its absorption of gas. Acid from gas neutralizes alkali in soil.



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You Spring from

Here's the mechanical lowdown on springs—those silent, unseen forces that work for you thousands of times every day.

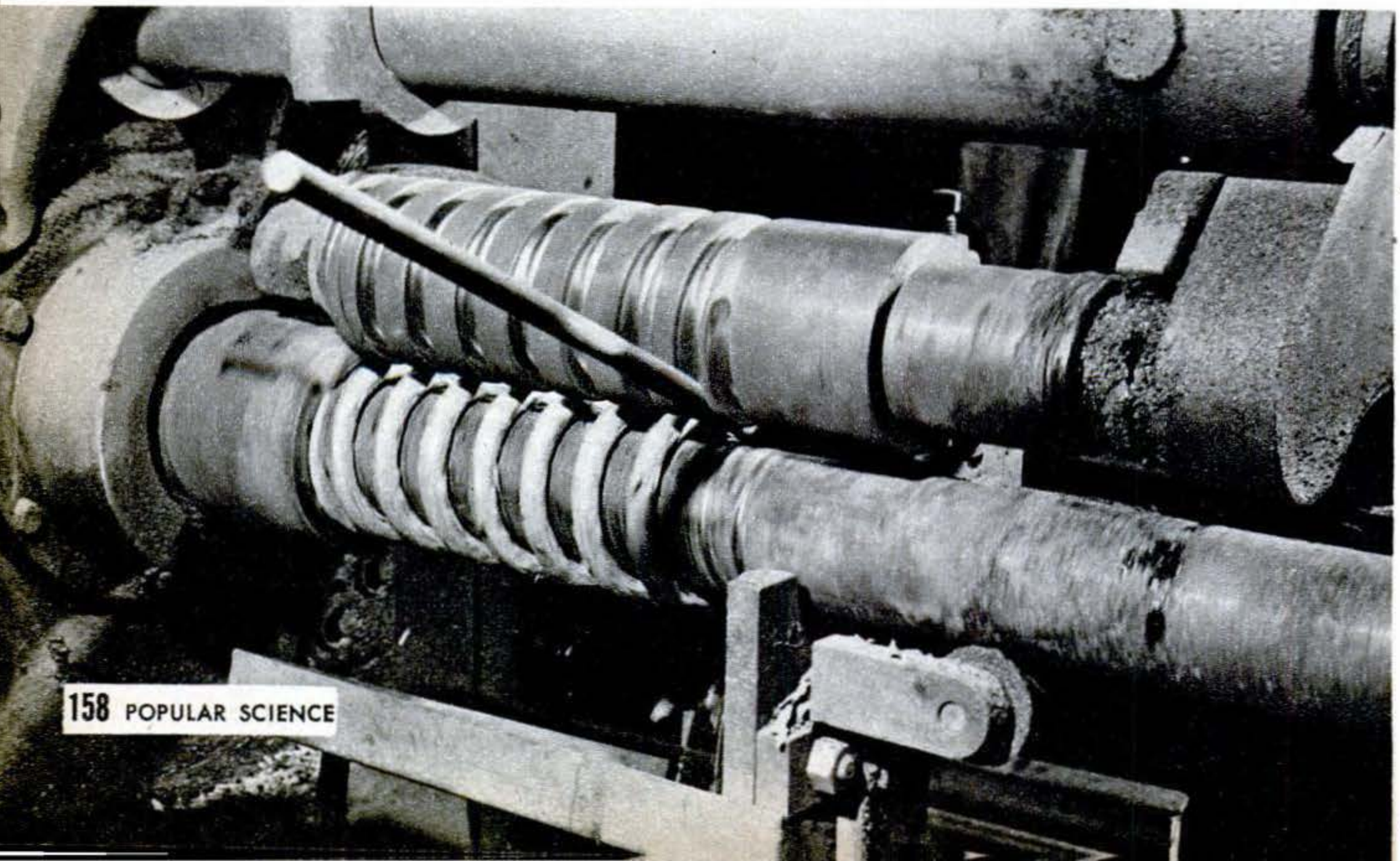
By George H. Waltz, Jr.

PS photos by W. W. Morris

YOU have depended on springs ever since your mother pinned your first diaper on you with springs in the form of safety pins.

A spring makes it possible for the alarm clock to wake you—even if it's an electric clock, because most of them have at least one spring on the spindle used in starting the motor. You get up from a bed made soft by as many as 900 separate springs. When you flip

Large springs are hot-wound. Spiral-grooved guide roller coils wire around a turning shaft.



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Morning to Night

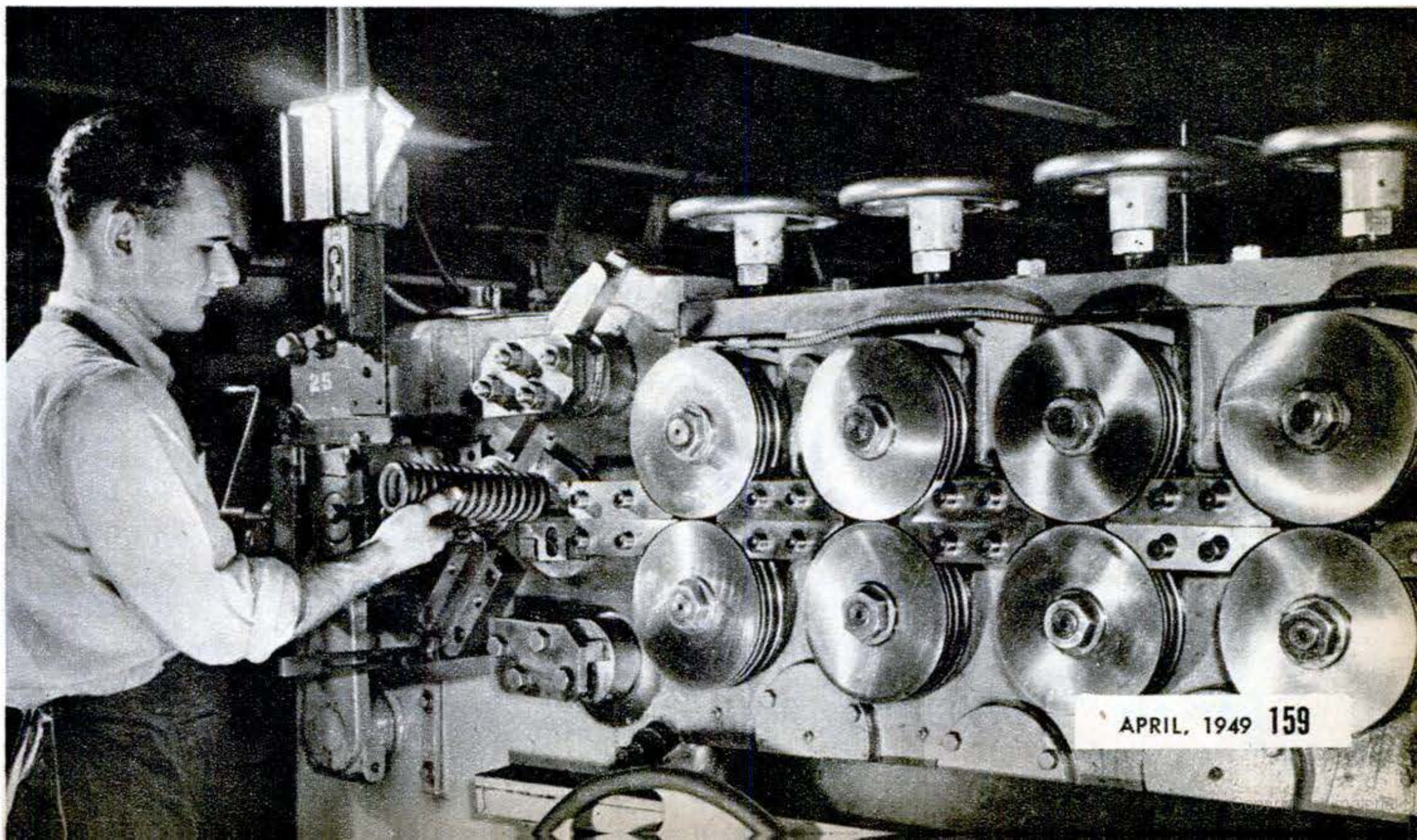
on the light in your bathroom, at least three more springs spring to your service. Every time you open or shut a door you use springs in the catches.

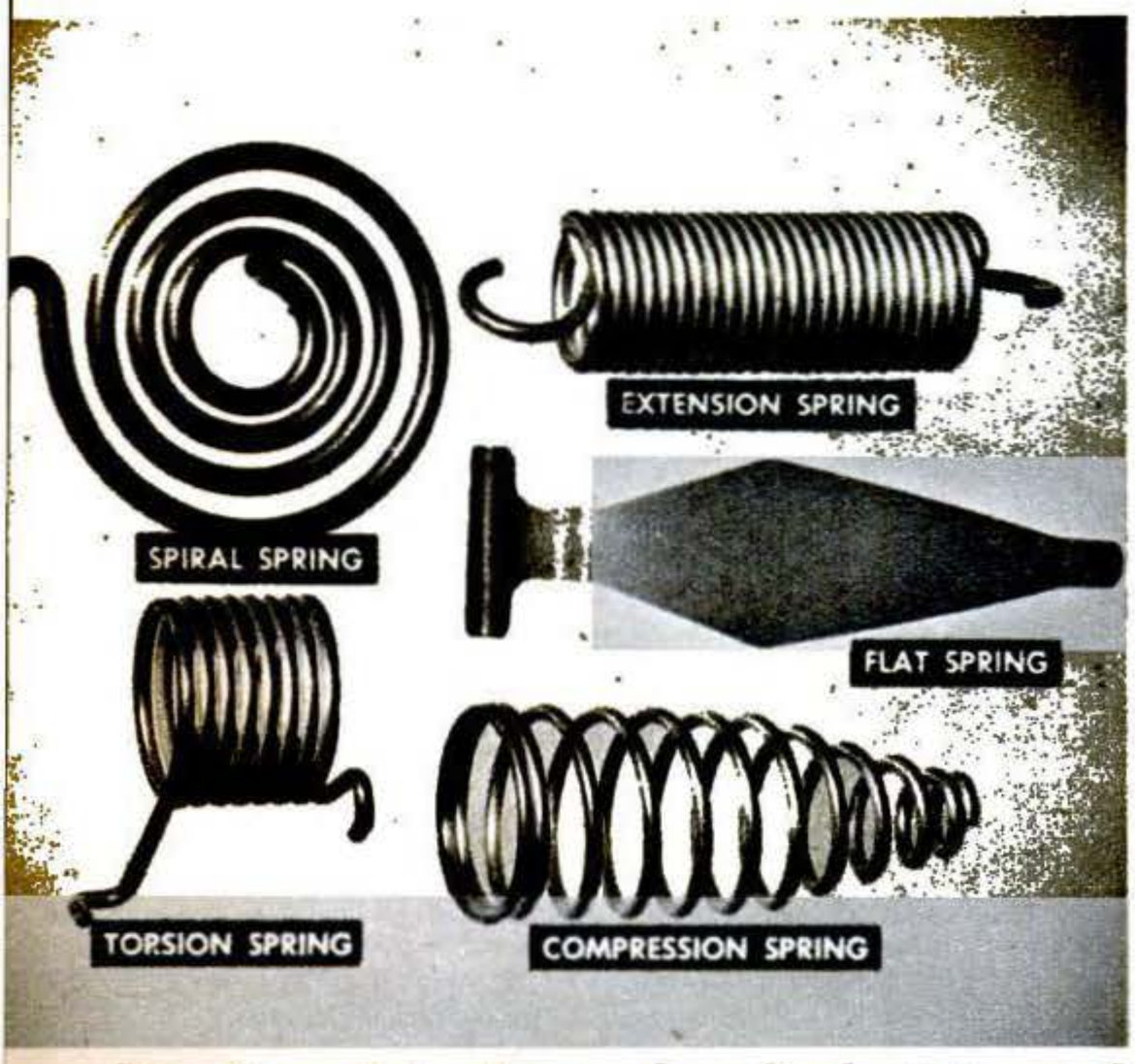
Your electric shaver contains still more springs, and the chances are your shower curtain is attached by a dozen or more springs in the form of snap hooks. When you dress you may put on a few springs in the form of tie and collar clips. Up to 80 more springs in your toaster, ice box, stove, coffee maker, kitchen cabinets, and mixer-juicer may join forces to help prepare your breakfast.

Finally, when you start out in your car, you sit in the midst of some 250 assorted springs, each important to the car's operation. And by bedtime, according to your spring-driven watch, you're likely to have used several thousand more springs.

It had never occurred to me how many

Small springs, made of wire under 5/8 of an inch thick, are cold-wound on automatic machines.





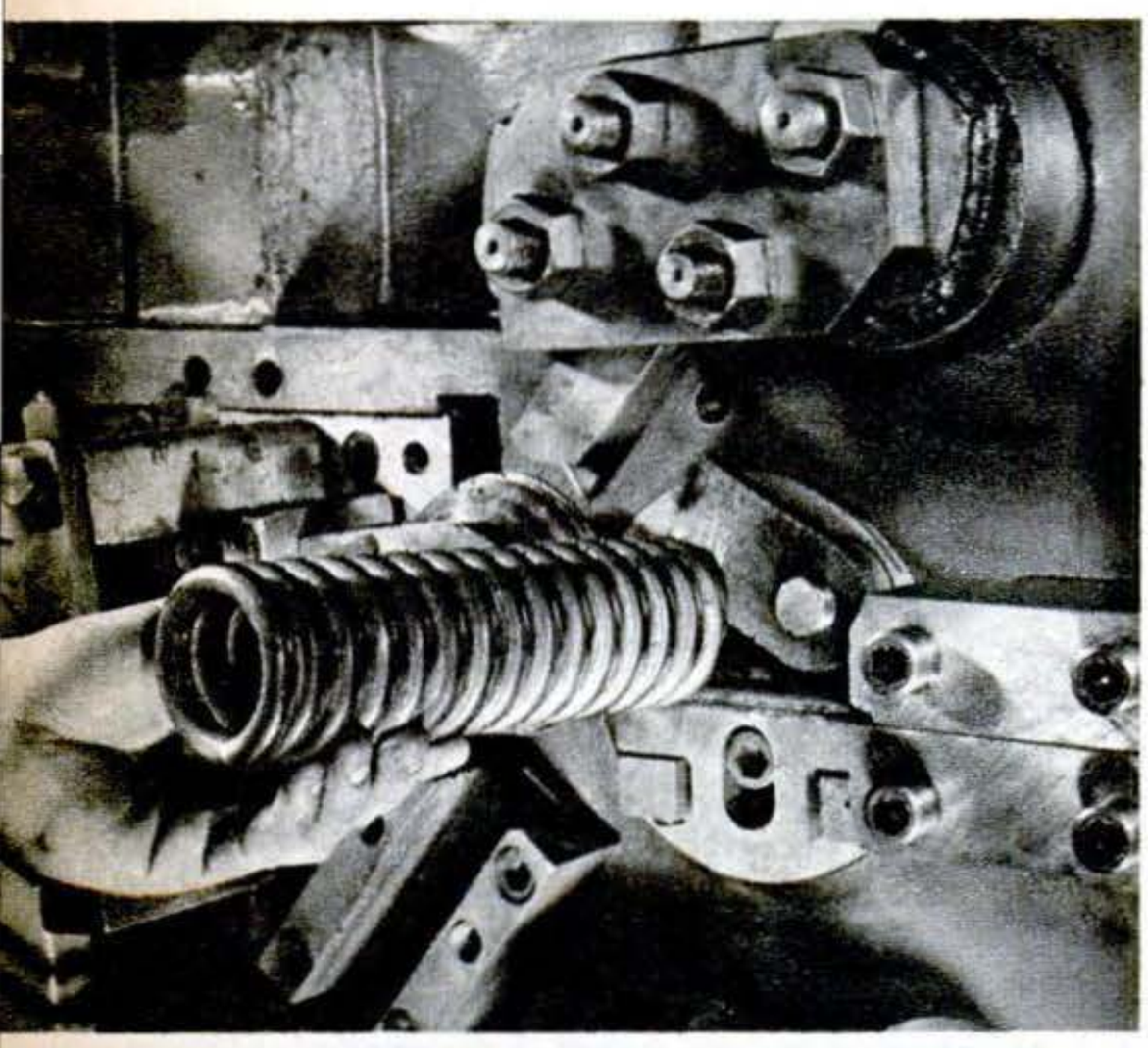
Despite variety of uses, these five basic types of springs do all the world's spring jobs.

springs I used until Bill Morris and I packed up the PS "prowl" car with cameras, flash bulbs, and other photographic gear and headed out to Lansdale, Pa., to visit the Hunter Spring Co. There I found that a spring is a good deal more than just a simple coil of wire. I saw springs being made in all sorts of shapes and sizes for all sorts of jobs. I came to realize, too, that there was a canny knack in making a spring that would deliver just the right tug or shove—from a featherweight force of a few grams to one of several thousand pounds.

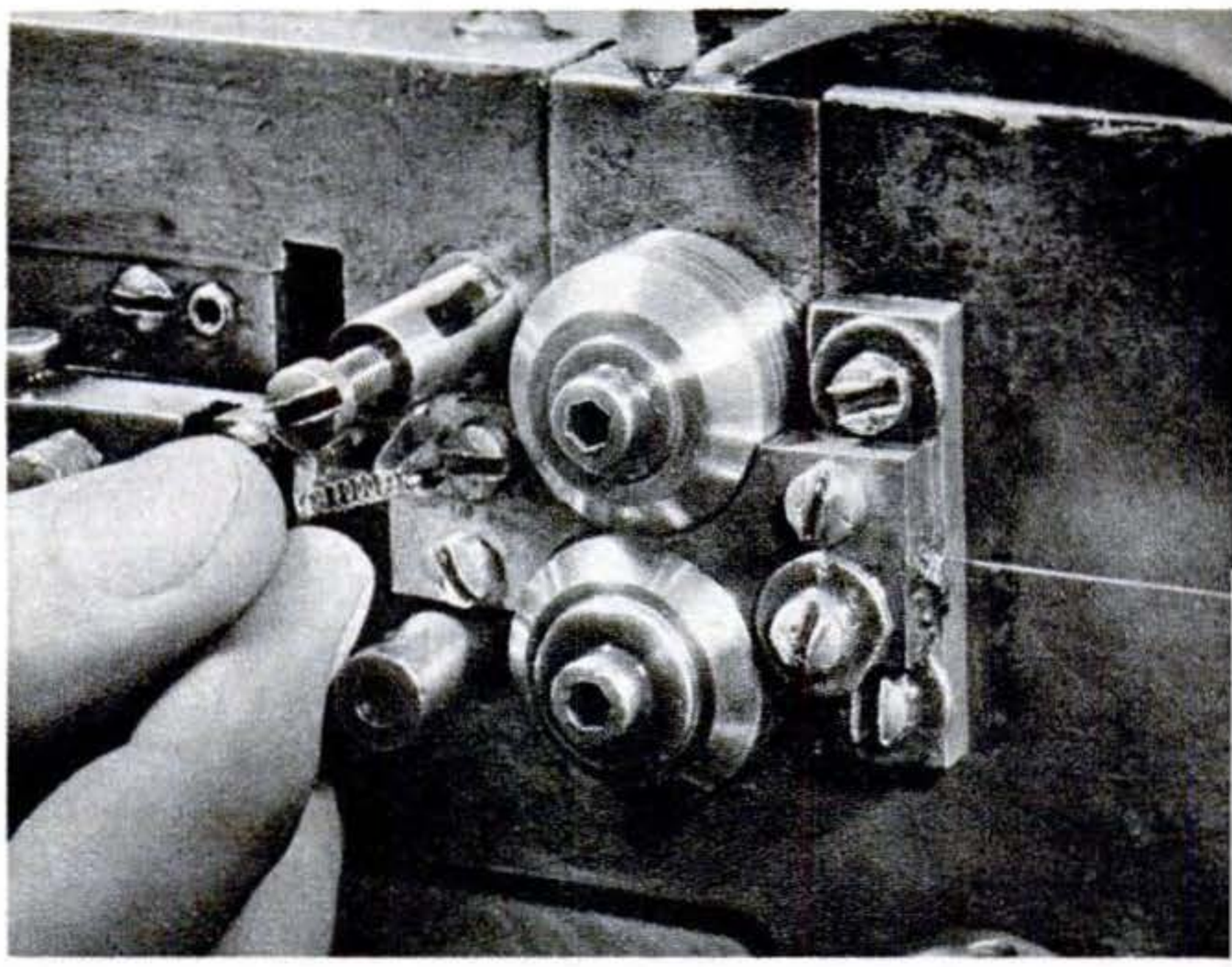
Yet, despite the many jobs that springs do, there are only five basic types:

The *compression spring*, which delivers a push—like the springs in a mattress.

The *extension spring*, which delivers a pull —like the kind that pops your toast up in the toaster when it is done.



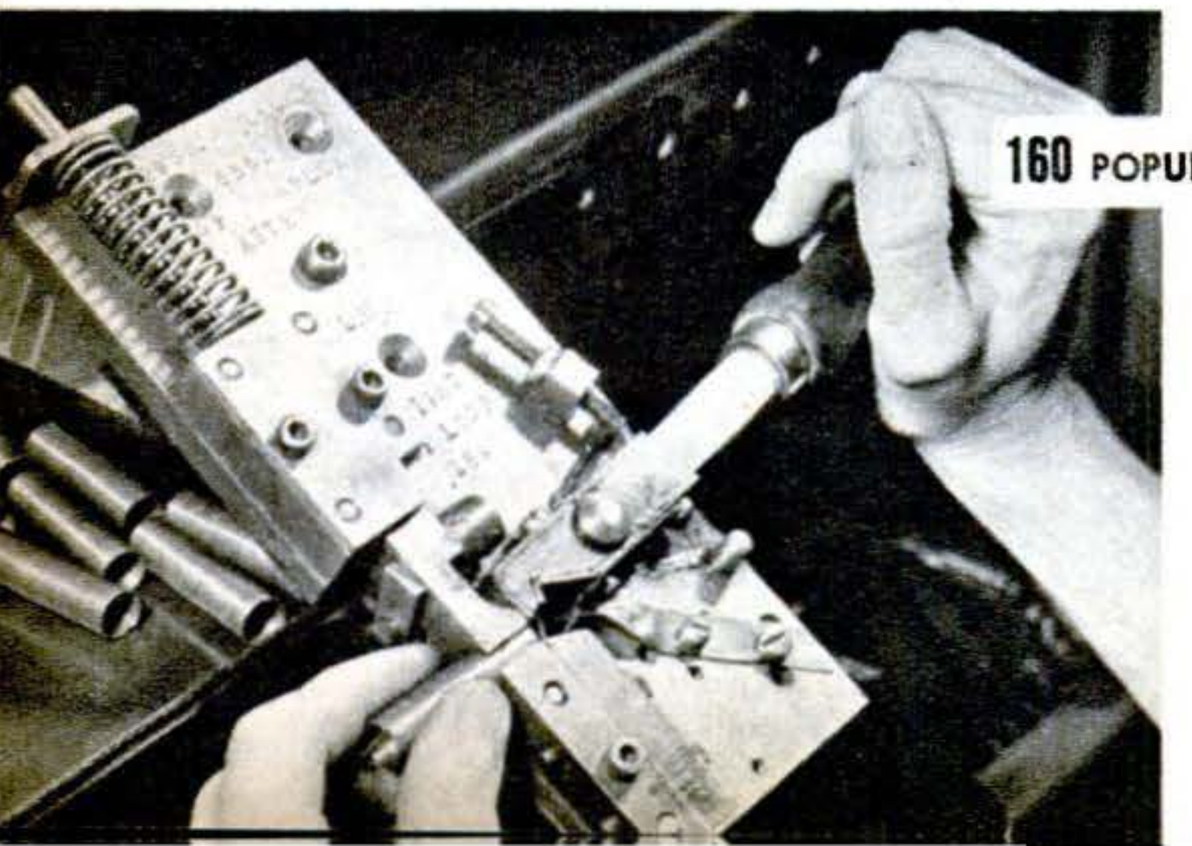
Cold-winding machines like one above are completely automatic. Three mechanical fingers inside, controlled by system of cams, gears, and levers, coil the wire around a central arbor.

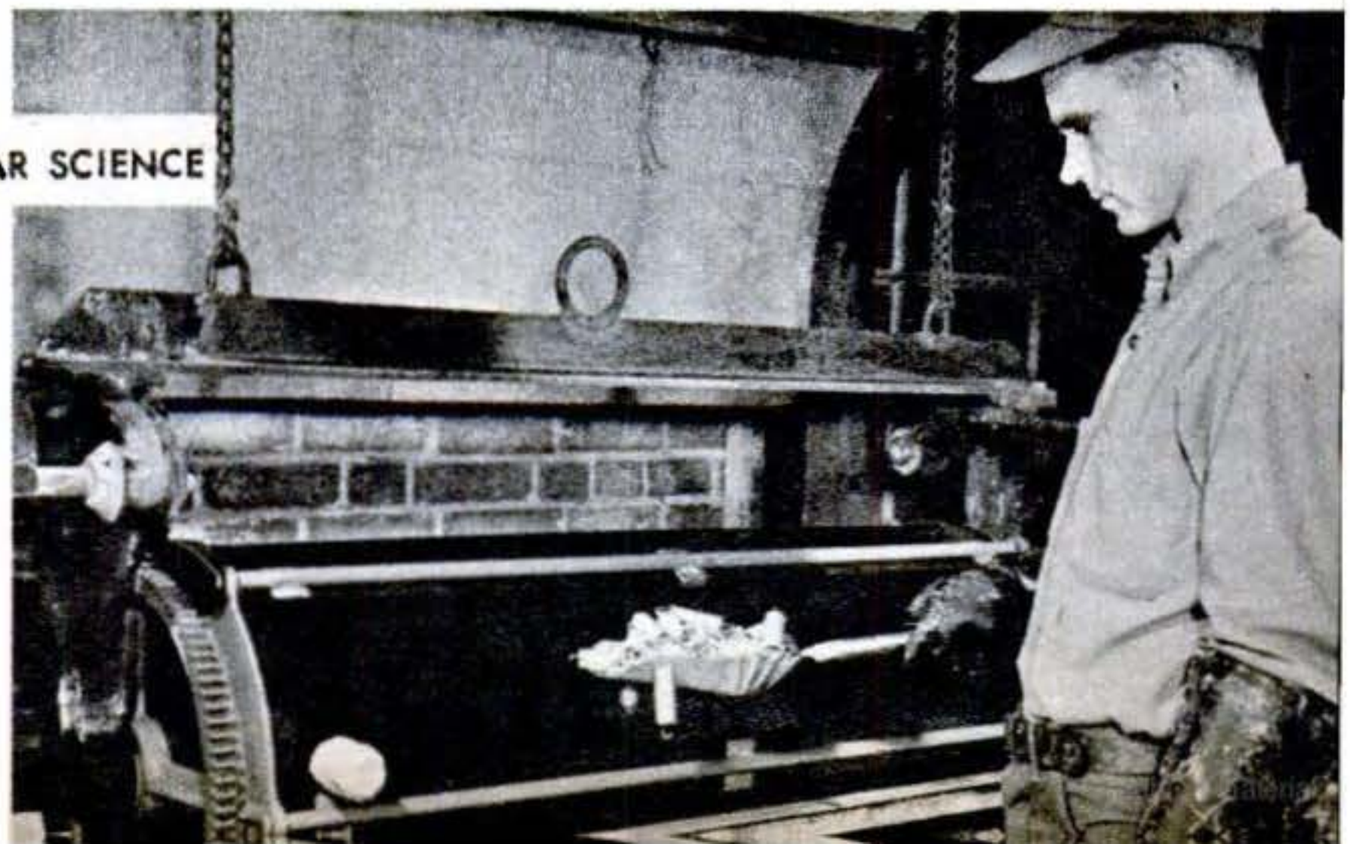


Small-spring winders are really miniatures of large-spring machines. Note tiny spring emerging from side like larger one in picture at left. Winder above makes 15,000 springs an hour.

Connecting loops on the ends of small compression and extension springs are formed in hand machine. Machine grips springs while handle bends back last coil on each end to make loop.

If springs require plating, they are placed in large, rotating, wire-mesh drums that douse them in desired plating bath. Many springs are plated to improve their appearance or durability.





The *torsion spring*, which exerts a twist—like those on the hinges of your screen door.

The *spiral spring*, which also delivers a twist but in its own plane—like the hair-fine coil that oscillates the balance wheel in your watch.

And the *flat spring*, which can be designed to exert either a push or a pull—like the leaves of the main supporting springs on your car.

Springs were among mankind's first devices for storing energy. The early wars were fought with rough-hewn wood springs in the form of bows and stone-throwing catapults. Today, springs are "tailor-made" for uses the primitive inventor never dreamed of. But there's no such thing as a standard spring.

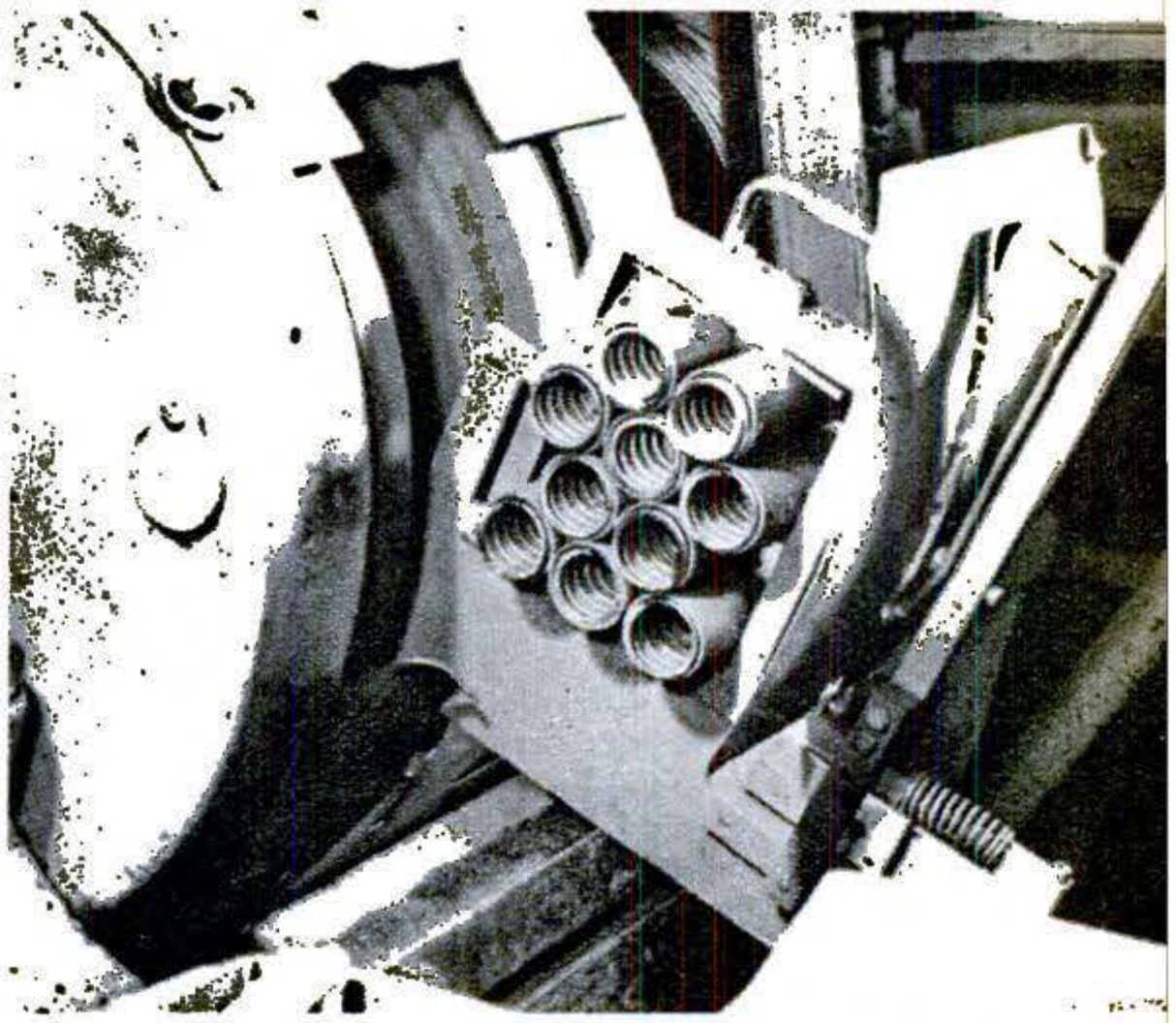
Each one is designed to strict specifications—size, force, shape, and life expectancy—and then carefully manufactured to meet those specifications. No product is produced with more meticulous precision or more careful testing than a spring that is to operate under strict tolerances.

At one time, coil springs were manufactured on lathes by hand – the wire being wound around an arbor fitted into the lathe's head. This method is still used for special orders in small numbers. But most springs now are made by automatic machines.

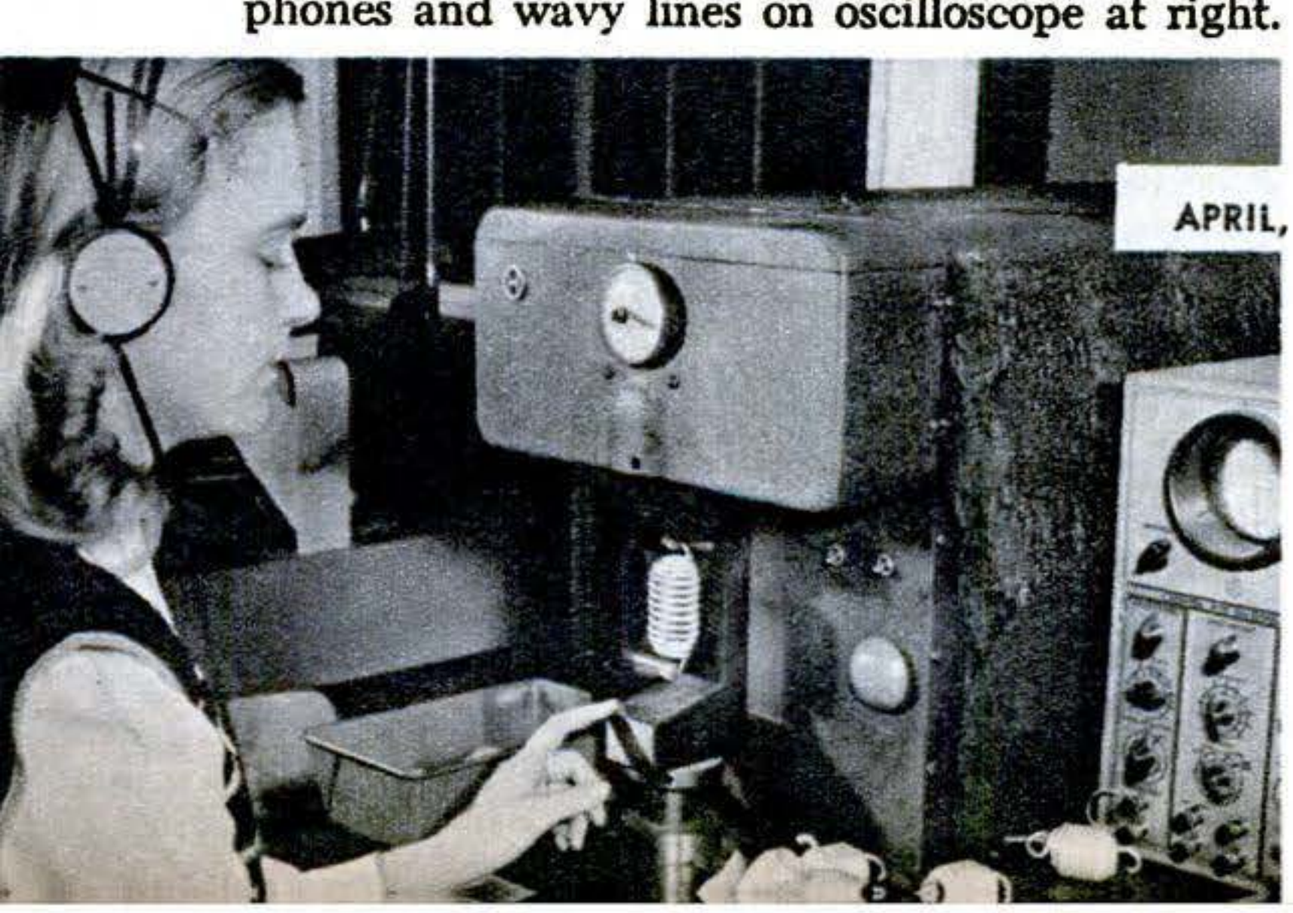
There are two general processes: *cold winding* and *hot winding*. Cold winding is used for springs made of wire up to ⅝ in. in diameter. Hot winding, in which the wire is heated and then worked, is used in making springs from larger wire.

The cold-winding machines are completely automatic once they are set up to produce a spring of a certain size and type. This operation consists of installing the proper cams and gears in the driving mechanism, and

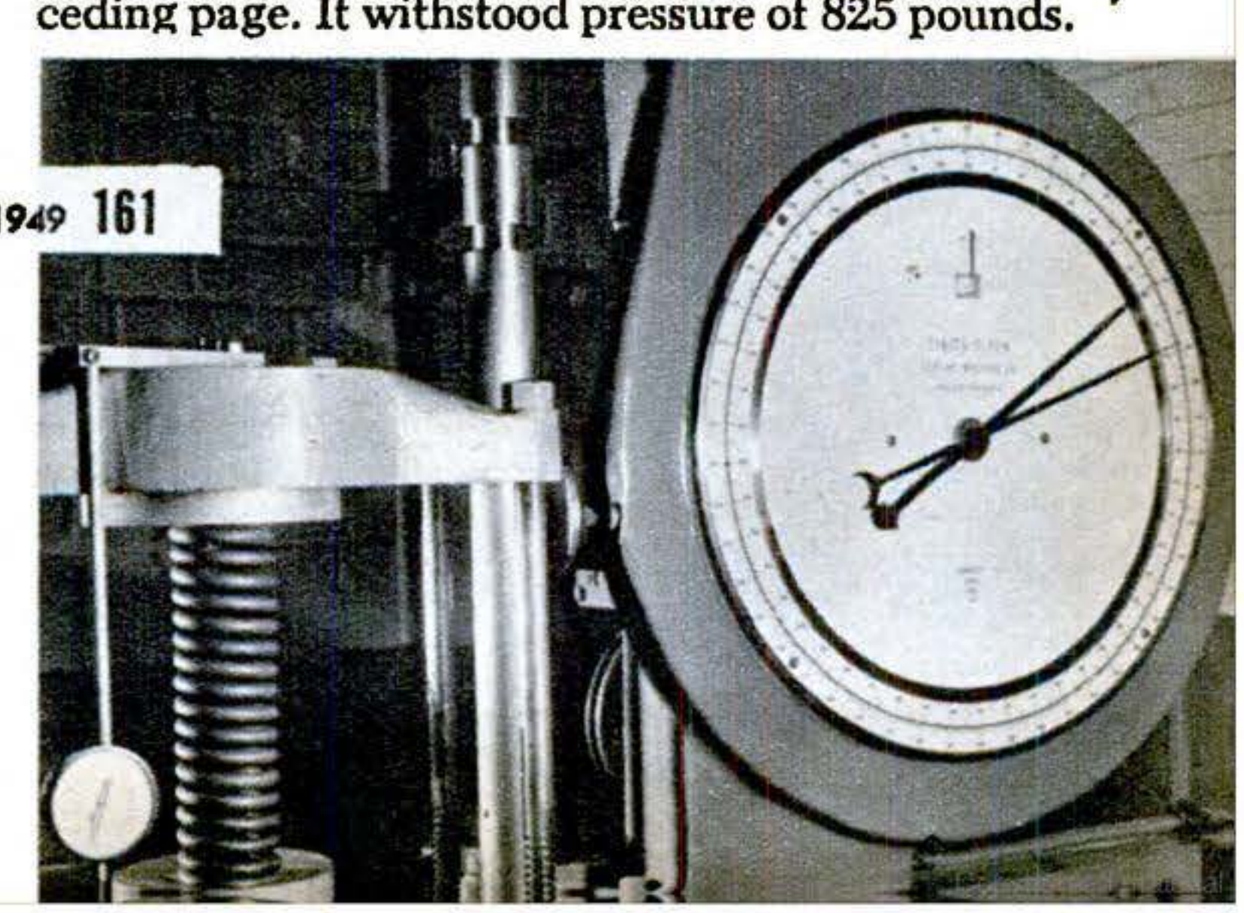
After winding, springs are heat-treated to remove any internal strains set up during coiling operation. Springs are lowered in bucket into furnace through circular opening shown above.



The ends of larger springs are ground flat to provide a good fit. Stack of springs, held in jig, is inserted between faces of two parallel grinding wheels so that both ends are ground at once.



Finished springs are carefully tested. Here device stretches springs for a washing machine. Faulty springs are detected by sounds in headphones and wavy lines on oscilloscope at right.



Powerful testing machines are needed for large springs. Here squeeze is being put on the big compression spring shown being made on preceding page. It withstood pressure of 825 pounds.

takes less than two hours. From then on the wire is fed in from a storage coil and the springs are automatically wound and cut to length. Machines of this type can turn out up to 15,000 small coil springs an hour.

The hot-winding process is more complicated because it requires heating and quenching. Rod stock, cut to the right length and tapered at one end, is first heated. A coiling machine then wraps the red-hot stock around an arbor. After coiling, the spring is quenched in an oil bath to produce the specified hardness. The best hot-winding machines can turn out about 200 big springs an hour.

"Tiny Tim" Turns Out Hairsprings

At the Hunter plant, springs are made of stock ranging from .004 in. to 7/16 in. in diameter on cold-winding machines. The machines, ranging from a Tiny Tim no larger than a typewriter to a mechanical twister about the size of a small car, turn out a wide variety of sizes, shapes, and types of springs. Mechanically, however, the smallest machine, which can produce coil springs that look like hair and exert a gentle force of a few grams, is no different from the largest machine, which can transform 7/16-in. rod into giant springs at a rate of better than one a minute.

In all cold-winding machines, three mechanical fingers, operated by cams, levers, and gears, wind the wire around an arbor, control the diameter of the spring and its pitch (the distance between coils), and cut it off to the right length. As one spring is cut off, the winding of the next is started. This may not seem like much of a trick with wire .004 in. in diameter; but when the largest machine is knocking out springs from 7/16-in. stock, the pressures and forces are tremendous. Yet, to watch the giant coiler, it seems as if the heavy steel rod were bent as easily as so much macaroni.

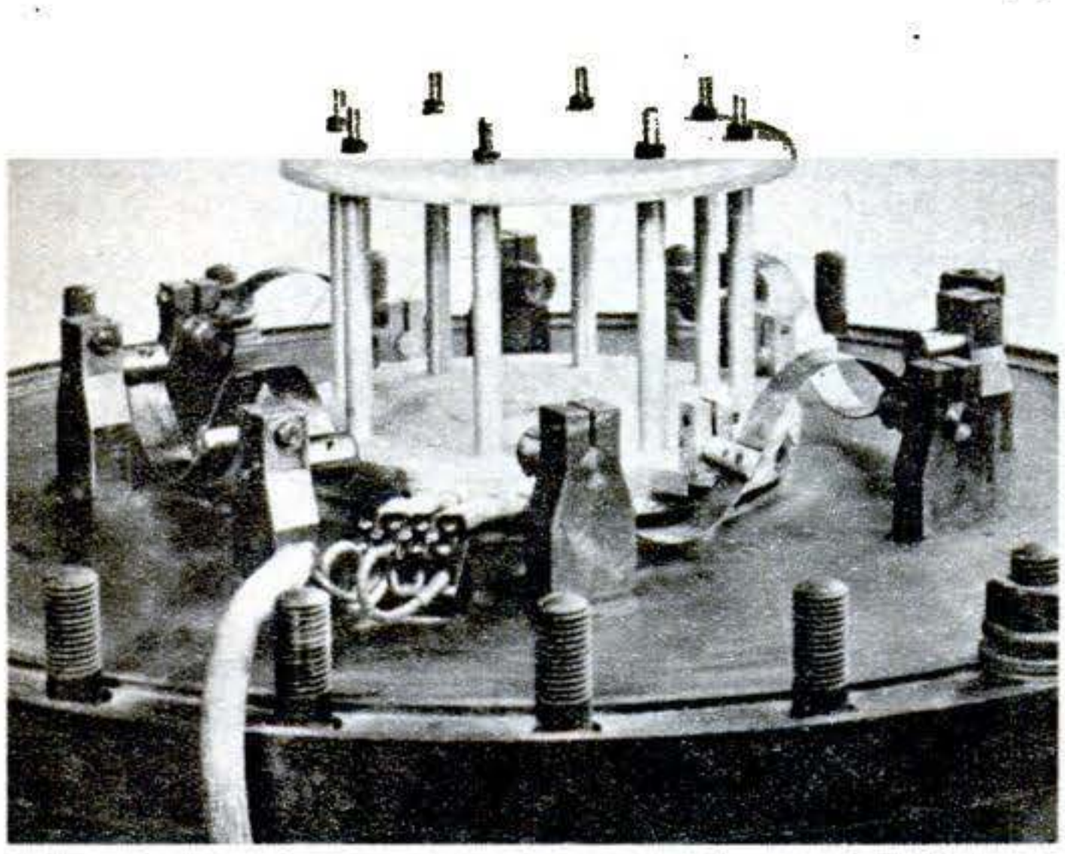
By adjusting the levers and installing the right cams and gears, the coiling machines can be made to perform any number of spring-making tricks: produce springs that are bigger at one end than the other; springs that start small, grow bigger, and get small again; and springs that have special ends. Even the pitch of a spring can be changed in the course of its length. And the coiling machines can do these things with an almost unbelievable degree of accuracy. They are even used to turn out the rigid copper tuning coils used in television sets.

A new spring is born on a designer's drafting board. By combining a knowledge of mechanics, mathematics, physics, and often chemistry and metallurgy, he creates its specifications. Design is important in a spring —it can cut weight and size to a minimum and boost accuracy and life to a maximum.

Some years ago, a manufacturer of pneumatic drills was having trouble with the springs on the mounting that held the drill bit. Under the best conditions, the spring would break after an hour of vibration. Today, thanks to good spring design, these misfits have been replaced with springs of just the right size, shape, metal, and tension. Now they last for the life of the tool.

Springs are precision items. Even the lowliest, like the safety pin, must be specially fashioned to do its particular job. "A good spring," says one spring expert, "is the result of close adherence to those 'tremendous trifles' known as tolerances." END

Adjustable Springs Support Changing Loads



ORDINARY springs must be designed for specific loads, but the new ones at left can take a variety of loads. Developed by British Signals Research and Development, they are S-shaped bands of steel supporting the load at the middle. Their stiffness can be varied by simply compressing or stretching them. It can even be made zero—so no weight is supported—or negative—so they move the other way. Compressing only one side causes the bottom of the S to push upward more than the top pushes downward. When the upward push exactly equals the downward push plus the load's weight, the springs are in equilibrium, and the load "floats."

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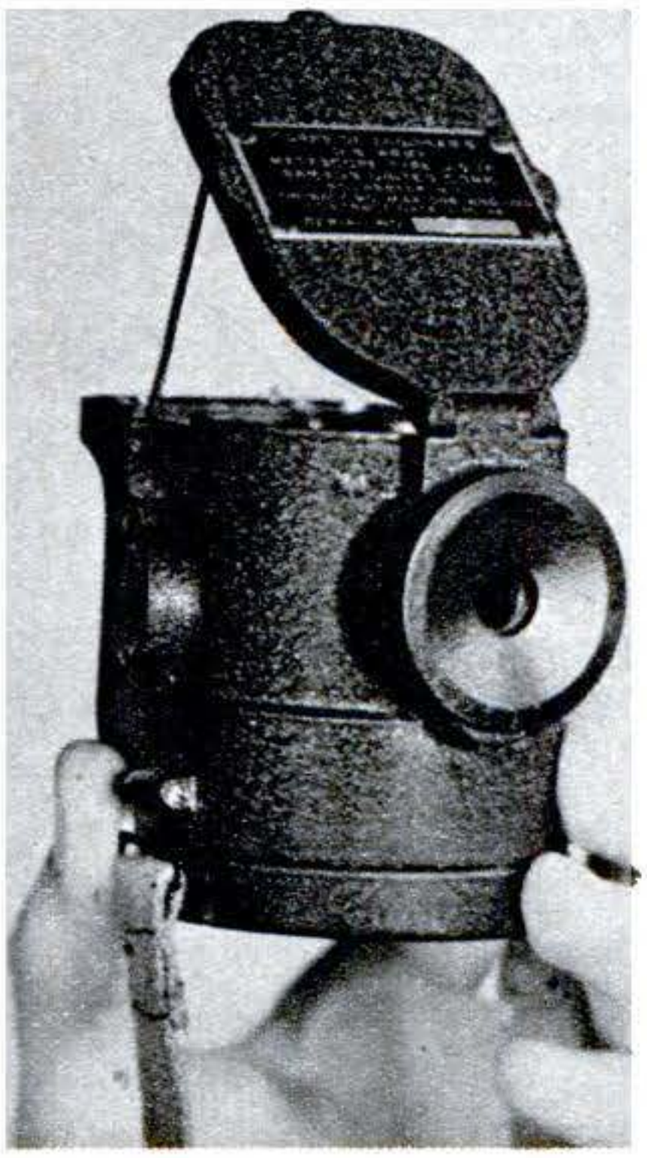
Platform Speeds Tree Pruning

TRIMMING 100 acres of prune trees at Windsor, Calif., was a long job until owners Don Du Vander and Pat Elsbree rigged up this tractor-mounted platform. Long enough to reach one side of four trees at a time, it can be raised to 12 feet for high branches. Catwalks permit close-in work. Access to the tractor is through a hole in the deck.



Scope "Sees" Invisible Light

PARATROOPERS can pick up coded signals in invisible infrared light with the new viewer at left. A mirror on the underside of the cover, shown open, reflects the light into a lens that focuses it onto a phosphor. The phosphor gives off a greenish glow, seen through the eyepiece. A radioactive substance keeps recharging the phosphor.

Station Wagon Is New Size

SMALLER than standard models, yet larger than the midgets, this flashy new Playboy station wagon introduces a light middleweight class into the station-wagon field. Weighing 2,350 lb., it seats five persons, with roomy storage space at the rear. It has a 96-in. wheelbase and an over-all length of 163 in. Its four-cylinder, L-head engine develops 48 hp. Expected to come out soon, the station wagon will cost about $1,500.

Pen Writes at High Altitudes

AIR travelers can take along this new Parker "51" pen without fear of its leaking. What's more, it's said to write well up to 35,000 feet. A tiny, valved "breather" tube connected to the ink reservoir allows air to escape without pushing ink out ahead of it as the outside pressure decreases at high altitudes. The reservoir is insulated against temperature changes by an air space between layers of aluminum and Pli-Glass®.

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Oil-Well Nuisance Becomes Dry Ice

THE oil wells that already gush raw material for scores of everyday products, from fuel and rubber to medicine and soap, are now the source of still another commodity. This time it is dry ice—frozen carbon-dioxide gas that is so cold you don't dare touch it with bare hands. It fills such varied jobs as preserving blood plasma, testing airplane equipment, and keeping ice cream hard.

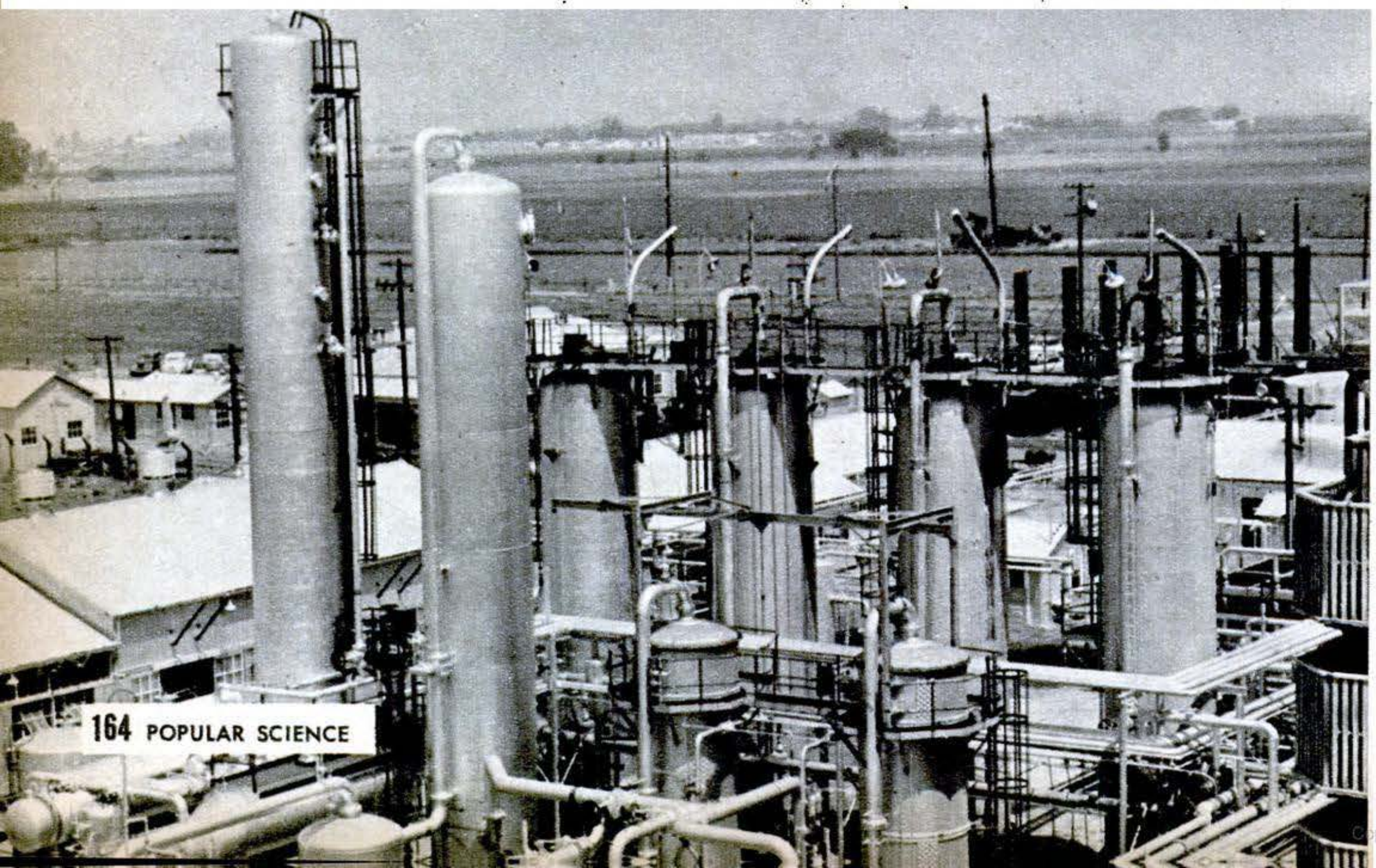
Dry ice has been made for years, sometimes from almost-pure carbon dioxide found in underground pockets. But carbon dioxide also comes up from some oil wells, mixed with the natural gas that often accompanies crude petroleum. Then it is a nuisance.

This is what happened in the Union Oil Company's wells at Santa Maria, Calif. Until last year the carbon dioxide had to be taken out of the natural gas and blown away into the air. Now a new million-dollar plant there is using most of this waste.

The new plant removes carbon dioxide from the natural gas by the Girbotol® process, developed by the Girdler Corp. A chemical called mono-ethanolamine streams down a tower while the mixture of carbon dioxide and natural gas flows up the tower. The amine chemical absorbs the carbon dioxide without affecting the natural gas. From the bottom of the tower, the amine, now containing absorbed carbon dioxide, is pumped to another tower, called a stripper. There it streams down again, but against an upward-moving mixture of hot amine and water vapor. This process releases the carbon dioxide, which is pumped to the dry-ice plant.

There the carbon dioxide is compressed and cooled until it is a liquid under 1,100-lb. pressure. The pressure is then released a little bit at a time. Each time pressure is let off, some of the liquid changes to vapor. This vaporization absorbs heat from the remaining liquid, so that the liquid becomes colder. Finally it freezes into carbon-dioxide crystals, called snow. Hydraulic plungers then compress this snow into cakes of dry ice.

In tallest tower (below, left), carbon dioxide is removed from natural gas by dissolving it in mono-ethanolamine solution. Next tower frees the carbon dioxide from the mono-ethanolamine.



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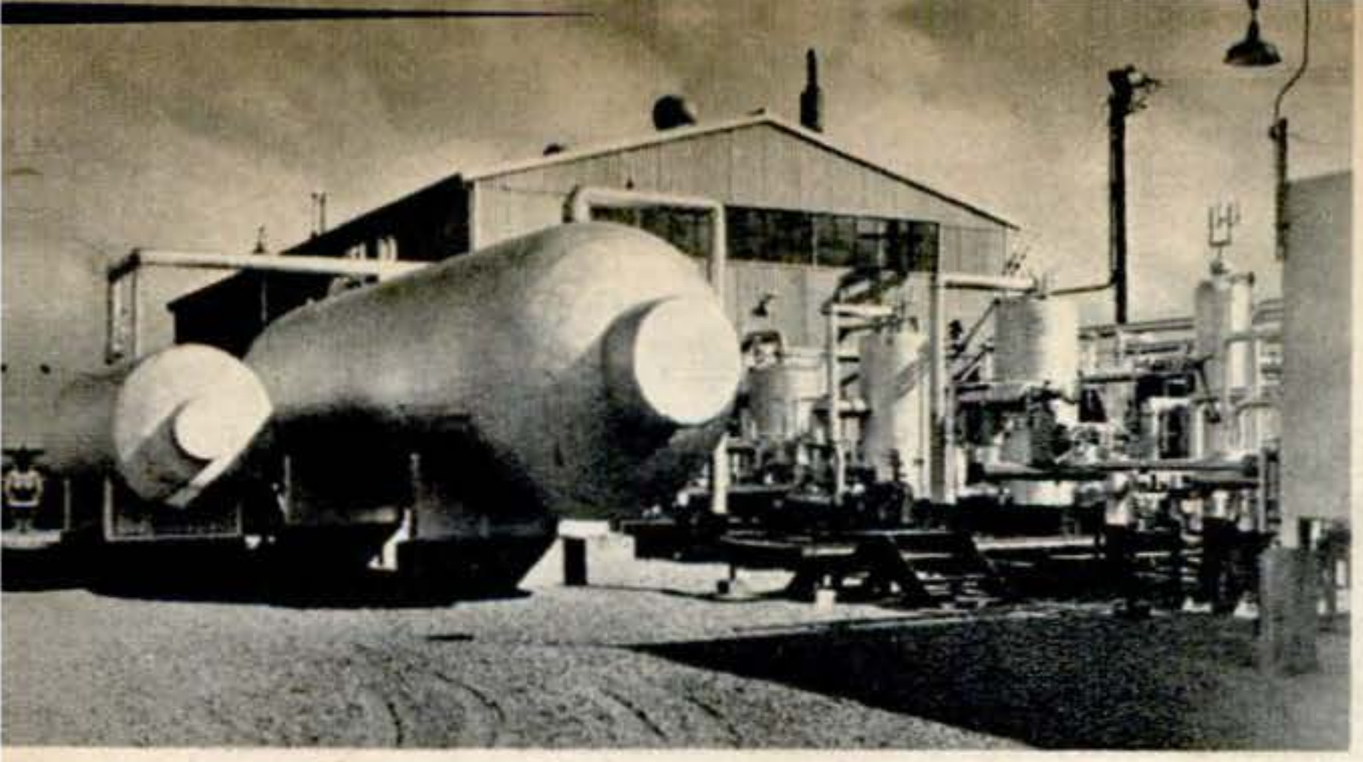
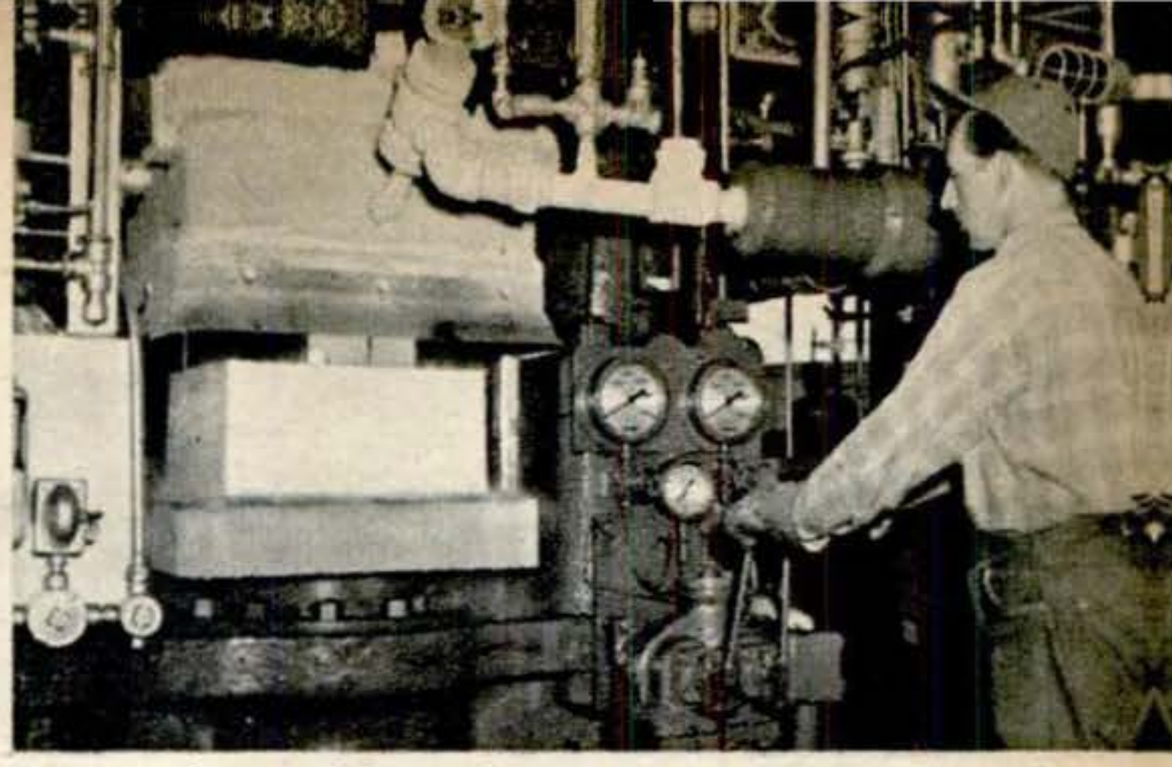
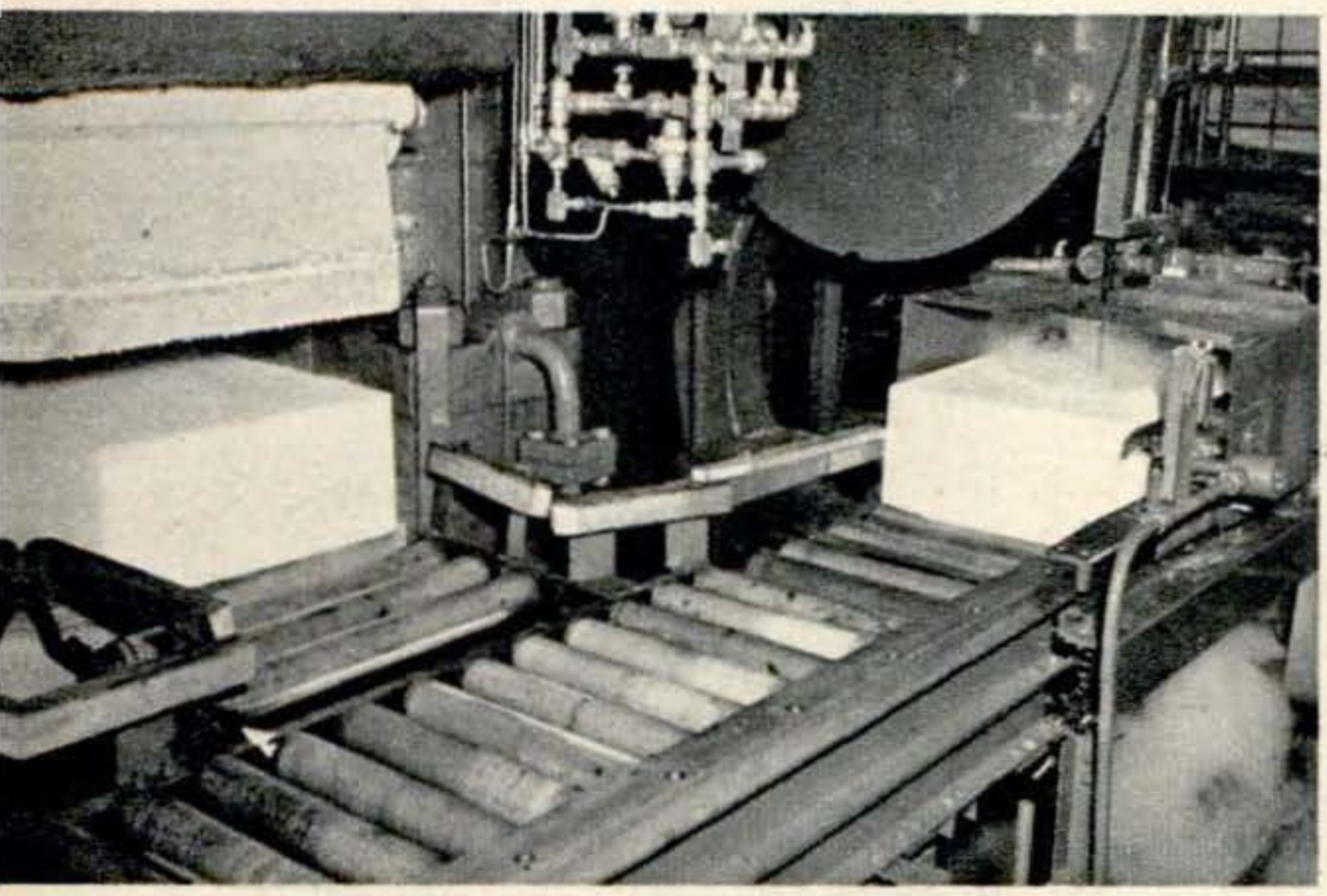


Large tank at center, above, is one of several holding purified carbon-dioxide gas during the stages of compression, cooling, and expansion that change it to so-called snow at −190° F.



Snow, obtained by releasing pressure on liquid carbon dioxide, is compressed into 240-lb. dry-ice cake by hydraulic press. Original volume of snow is reduced thousand-fold by the press.

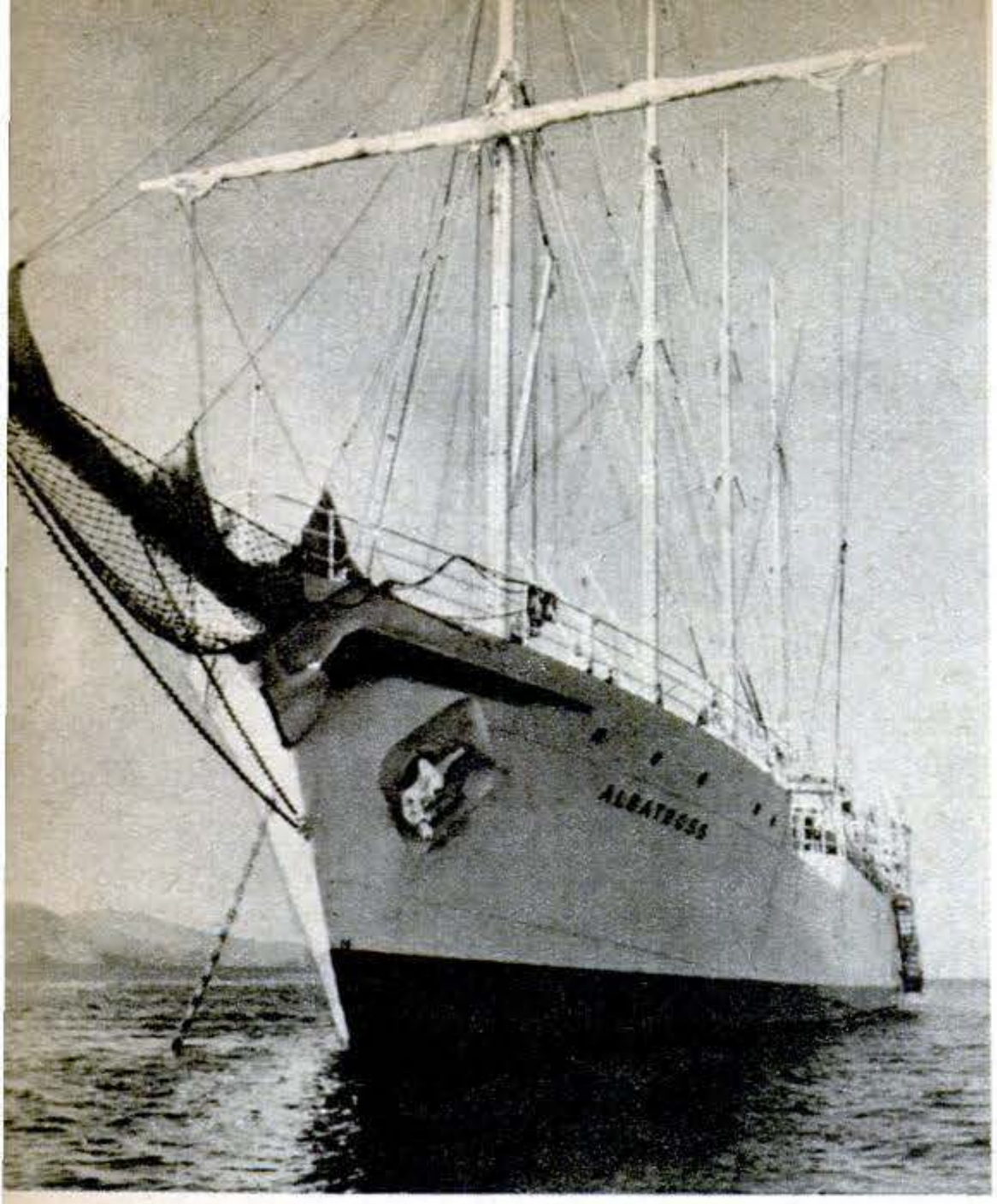


While one dry-ice cake (left) is waiting to be pushed onto the rollers, another (right) is being cut by band saw. Two such saws are used to slice the big cakes into pieces 10 in. square.

After being cut to size, the cakes of dry ice are wrapped in heavy manila bags, sealed with tape, and weighed on an automatic scale. The conveyor then takes them to storage or shipment.

These big storage bins (below) hold the packages of dry ice until they can be loaded into railroad freight cars. The bins are insulated and sealed with wood and heavy galvanized iron.

Plant official points out 8½-in. thickness of insulated door on specially built freight car (below) used to transport dry ice. Car holds 1,155 cakes with total weight of 69,000 lb.



Swedish motor schooner *Albatross* tested new ocean-bottom corer on recent 15-month voyage. The ship, a new 1,450-ton training vessel, was air-conditioned for this tropical cruise.

The new-type corer, capable of pulling 47-foot-long plugs from the bottom of the sea, is adjusted during the trip by its inventor, Dr. Borge Kullenberg, and the trawling master, Axel Jonasson.

'Apple Corer'

Tubular knife on a four-mile string "plugs" sea floor for cross sections of sediment millions of years old.

MILLIONS of years of history now can be pulled out of the bottom of the ocean. It's done with an automatic "apple corer" that works on the end of a four-mile string. The cores it brings up are cross sections of sediment, from which scientists can fix the dates of great volcanic eruptions, earthquakes, and ice ages that occurred long before any one spoke English on this bit of the universe.

Evidence like this may also help tell whether the American continents were once joined to Europe and Africa. One theory suggests that the Americas drifted away, leaving a big basin that has become the Atlantic Ocean. Other geologists say that the oceans now are pretty much the way they have been ever since the earth was formed.

Newest of the ocean-bottom "apple corers" is one invented by Dr. Borge Kullenberg, a Swedish scientist who adapted it from a device used by the Swedish railway system to obtain samples of ground along prospective track routes. It can pull longer plugs than any other device, thus providing more information in a single sample.

How Sampler Works

Called a piston core sampler, it consists mainly of a weighted, brass-lined steel tube about 20 yards long with a close-fitting piston inside. As shown in the sketches at the right, counterweights dangle from one end of a lever, balancing the tube, which is loosely hooked to the other end of the lever. The counterweights hang slightly lower than the end of the tube, so that they hit the ocean bottom first. This lets the lever swing up and drop the tube.

The weight of the tube drives it into the ocean bottom. The piston, however, remains fairly stationary, creating a vacuum that helps pull long cores into the tube. Doors like clam shells then close over the mouth of the tube to help the vacuum hold the core inside the tube on its long ride to the surface.

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Taps History

The piston sampler was tested extensively on the recent 15-month trip of the Swedish research vessel *Albatross*—which should not be confused with the U. S. oceanographic research ship *Albatross III* (PS, Feb. '49, p. 121). On that voyage the sampler brought up 250 cores, including the longest one ever obtained—47 feet long.

A glance at one of these cores shows it made up of many layers—something like a huge roll of varicolored candy drops. Yet it takes a whole year for Britain's Natural History Museum to complete analysis of just six inches of the sample.

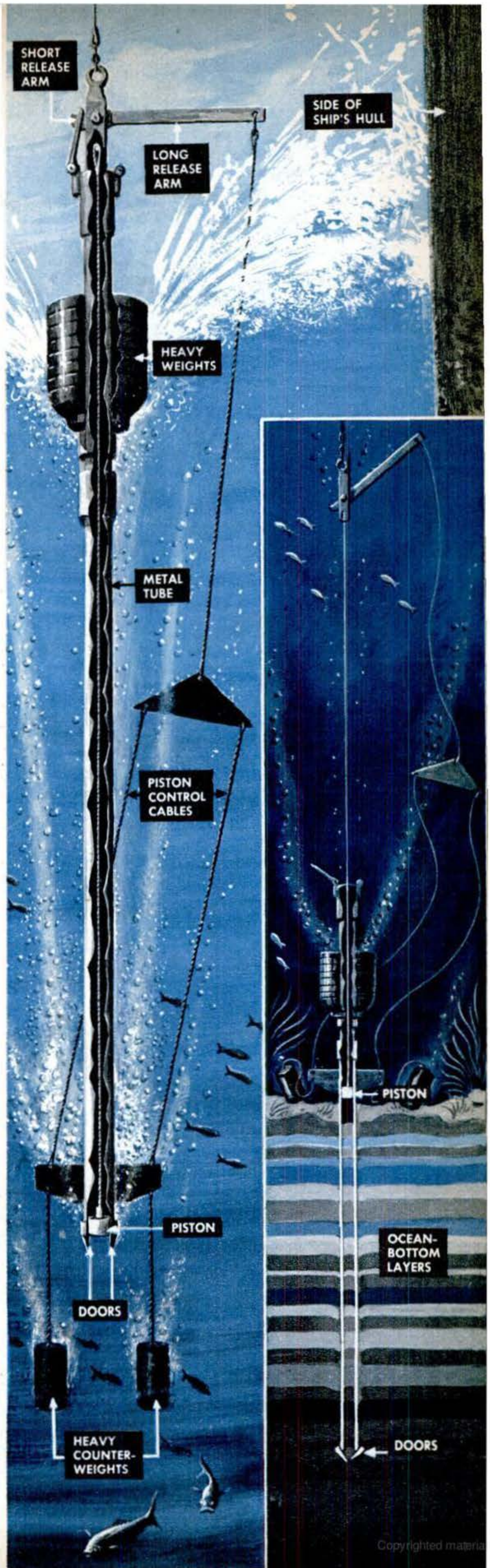
How Secrets Are Unlocked

Secrets imprisoned in the cores can be decoded in two ways. One method involves meticulous chemical analysis of each bit of mud, sand, etc., to learn the quantity of elements in the sample that were formed by radioactive change from other elements. Once the weight of a "daughter" element is known, it is fairly easy to date that part of the sample, since the time required for the "parent" element to create a given amount of "daughter" is known.

The other method is to identify the long-dead animals and plants imbedded in the sediment brought up by the corer. Knowing when these fossils were alive, scientists can tell when a particlular layer of sediment was formed.

Many of the cores pose unexpected—and still unanswerable – questions. One raised hundreds of miles off the Atlantic Coast by Dr. Maurice Ewing, of Columbia University, contains a layer of sand. Sand is formed by the disintegration of rocks, but there are no rocks of that kind anywhere near the area where the core was taken.

That mystery and many others about the earth and its oceans may not be solved until many more plugs have been pulled out of the ocean bottom. END



Vacuum action of piston in new corer helps pull long plugs into cylinder. Cylinder is released, driving itself into ocean bottom, when counter-weights strike bottom and trip support lever. Piston remains stationary to create vacuum.

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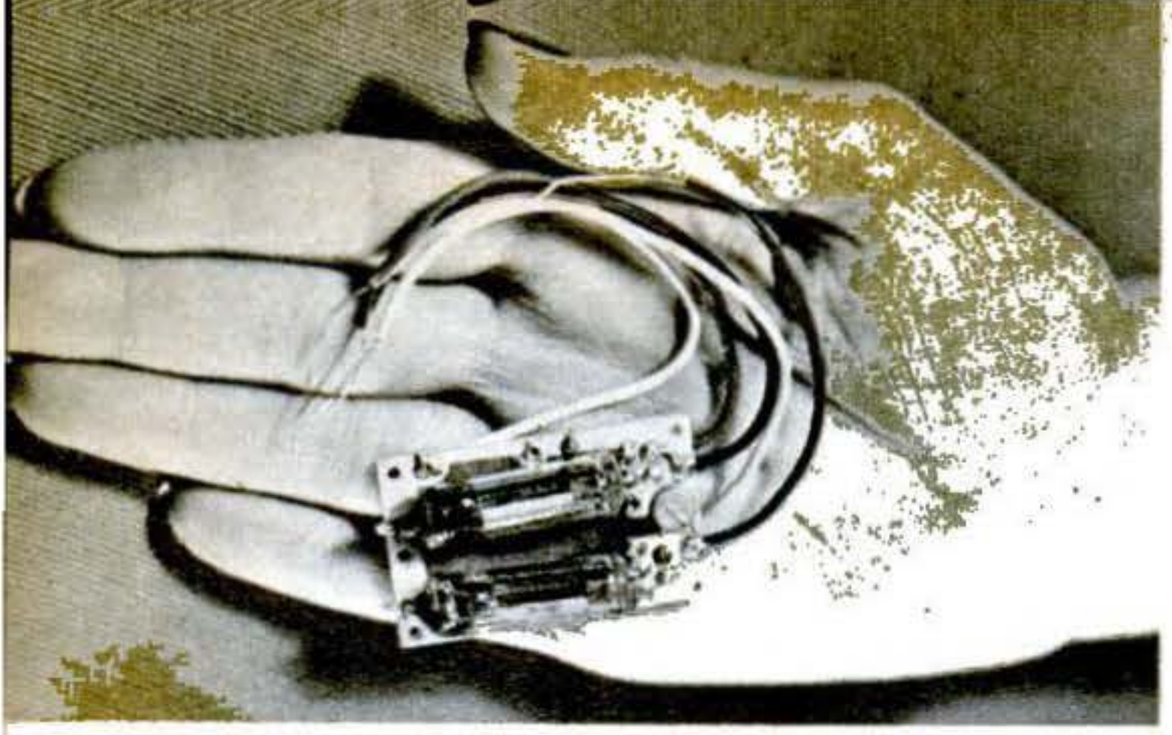
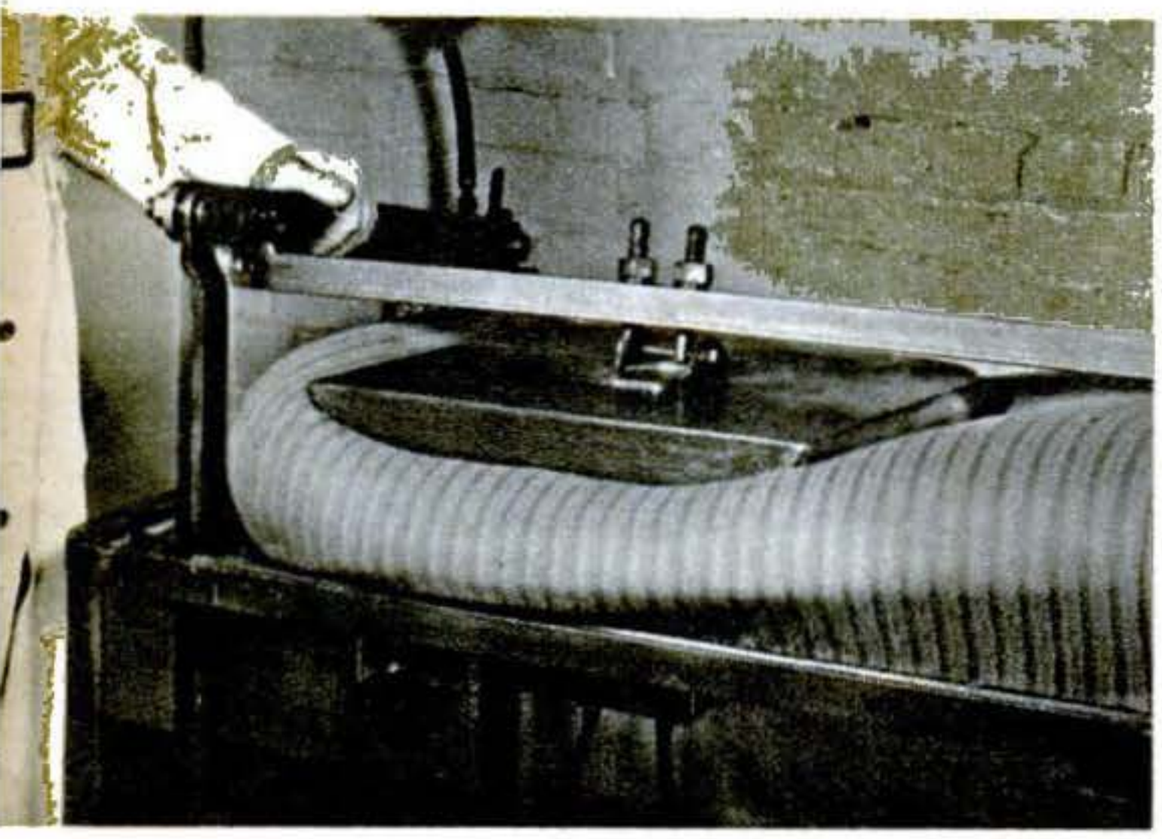


Walkie-Talkie Weighs 2½ Lb.

MIDGET parts, including the two miniature tubes above, keep this new civilian walkie-talkie to a fourth the size of wartime military outfits. The "transceiver," with folding antenna, weighs only 11 ounces; a headphone and batteries, carried in a separate case, less than 2 lb. The set is made by Citizens Radio Corp., of Cleveland.

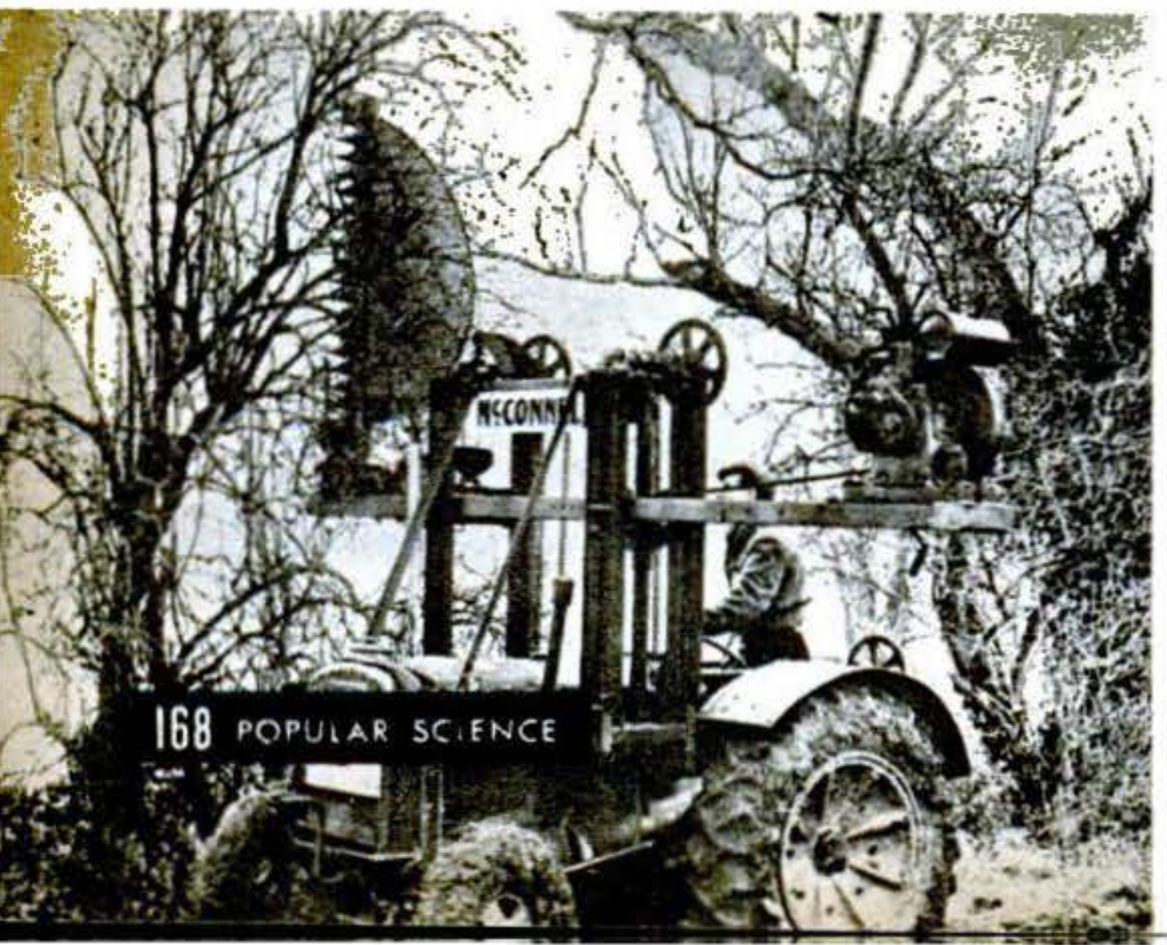


Bouncer Tests Car-Seat Fabric

THIS machine gives a car seat as much abuse as would a 175-pound man sitting down and getting up 200 times a minute. Nash Motors uses the device to test proposed seat-covering materials. A similar tester subjects the covering to sideways rub. To pass, a fabric must take 10,000 bounces and scrapes without showing damaging wear.

Phonograph Shows Pictures

As it plays a recording of a nursery song, this child's "television set" shows the story in colored pictures. A cardboard strip holding 17 frames of 16-mm. film is attached to a disk synchronized with the record. A lamp and mirrors project a frame every 11 seconds on a 4½- by 6-in. screen. Photo Electronic Co., of Chicago, makes the toy.



Motorized Mower Trims Hedges

AN English farmer invented the tractor-mounted saw at the left to speed hedge trimming. A heavy-duty mower blade on one end of the crossarm is driven by a gasoline engine on the other. The arm can be raised or lowered and extended to the left or right. The hinged blade, besides operating vertically up or down from the arm, can be swung straight out to trim the tops of hedges. It cuts through branches up to about an inch thick.

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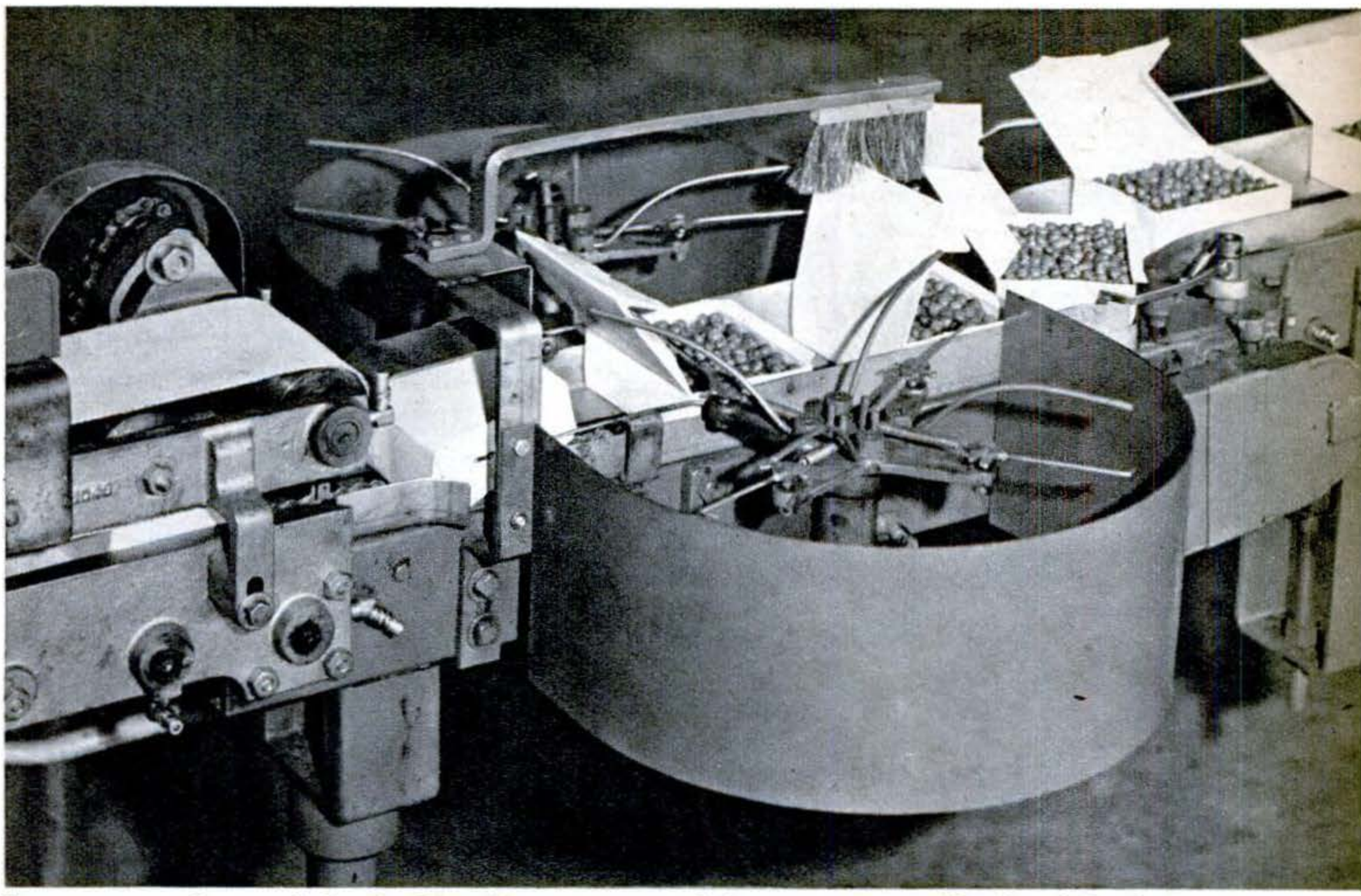


Ingenuity is the word for food-handling machines. Here long-bristle brush and revolving steel fingers automatically close lids of pea cartons. Compression unit at left seals them.

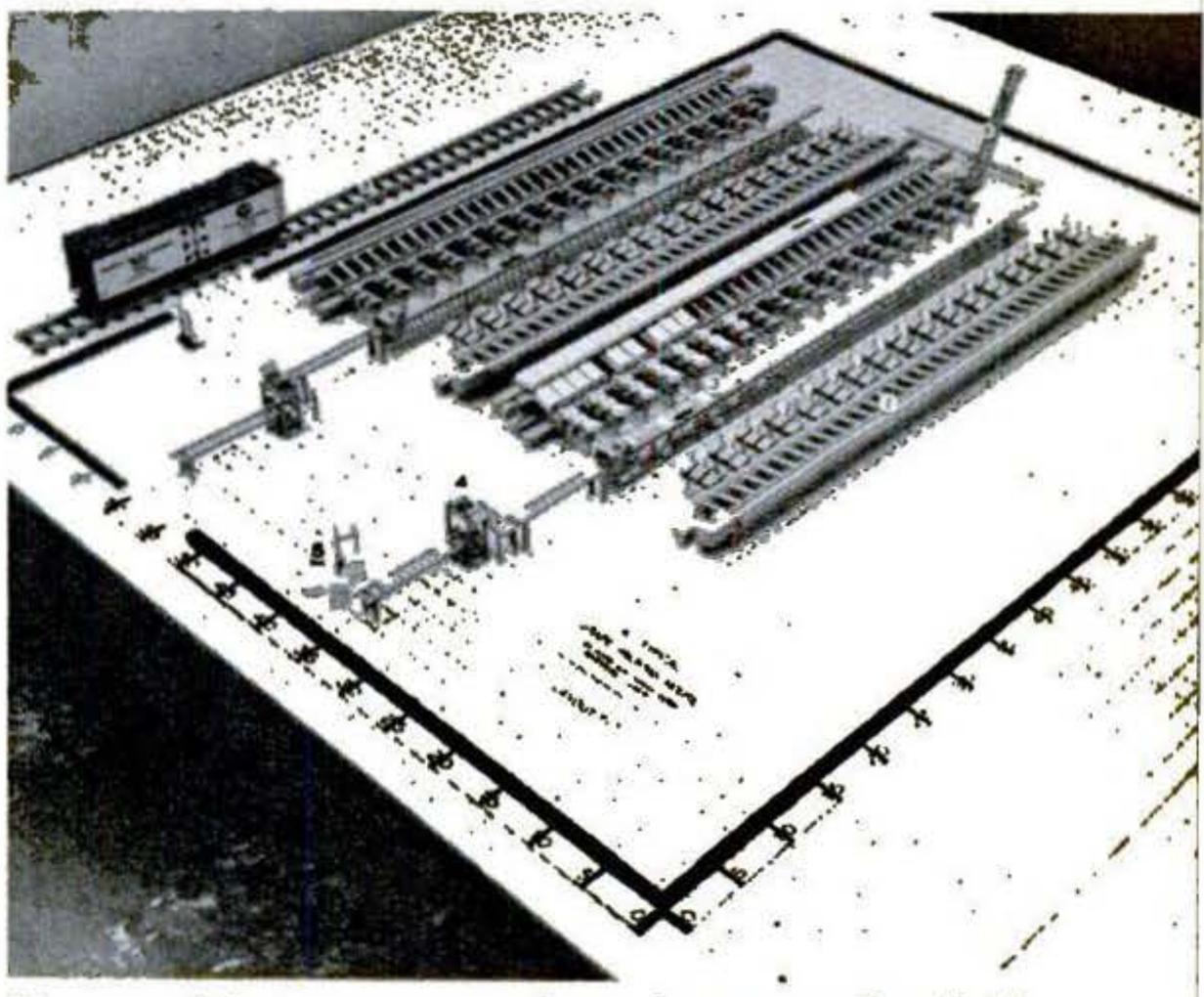
Mechanical Hands Prepare Your Food

By Andrew R. Boone

THE hands that can the peaches, squeeze the juice, and freeze the vegetables and meats you eat are cleaner and quicker than any human hands – however scrubbed and expert.

For big-scale food preparation has been taken away from the cook and given to the engineer. The push-button boys have learned how to make steel and electricity perform a thousand processing jobs, from squirting exactly enough oil into sardine cans to separating juice from rind oil when squeezing citrus fruits by the carload.

Operating near San Jose, Calif., is a new canning plant, designed by the Food Machinery Corp., that splits, pits, peels, cans, cooks, cools, labels, packages, and delivers a clingstone peach into a waiting truck or boxcar in 45 minutes—at a rate of 9,000 cans an hour



New packing or processing plants are first laid out with models, complete in detail. Machines are then built to conform to most efficient plan. Model above is for grape-packing plant.

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for each production line in the cannery.

A hydraulic ram, shoving stacks of crates from wooden pallets onto a powered conveyer, starts the peaches moving. Another belt, running at right angles, picks up the crates in single file. A dumper lifts them up the side of a tall frame, then slides the fruit onto a third conveyer. From this belt, the peaches move over a series of rubber rollers that grade them for size.

Selected sizes ride still other belts to the pitting machines. There a thin saw splits meat and pit in half. Cuplike knives lift out the pit halves. Jostling along a shaker table knocks off the pieces, and the halves ride into the peeling machine. After jets of steam and a chemical bath remove the skin, cold-water sprays wash off the chemical and any remaining bits of skin. Then a slicer splits each half into seven segments.

Moving along another belt, the slices fall from pockets into cans. Just the right amount of syrup is added when the cans press upward on a lift table against a series of valves. The cans then ride into a steam box that preheats the fruit and drives out air. A sealing machine clamps on the lids. Climbing a conveyer, the cans slip through a rotating valve into a continuous cooker and cooler operated by one man.

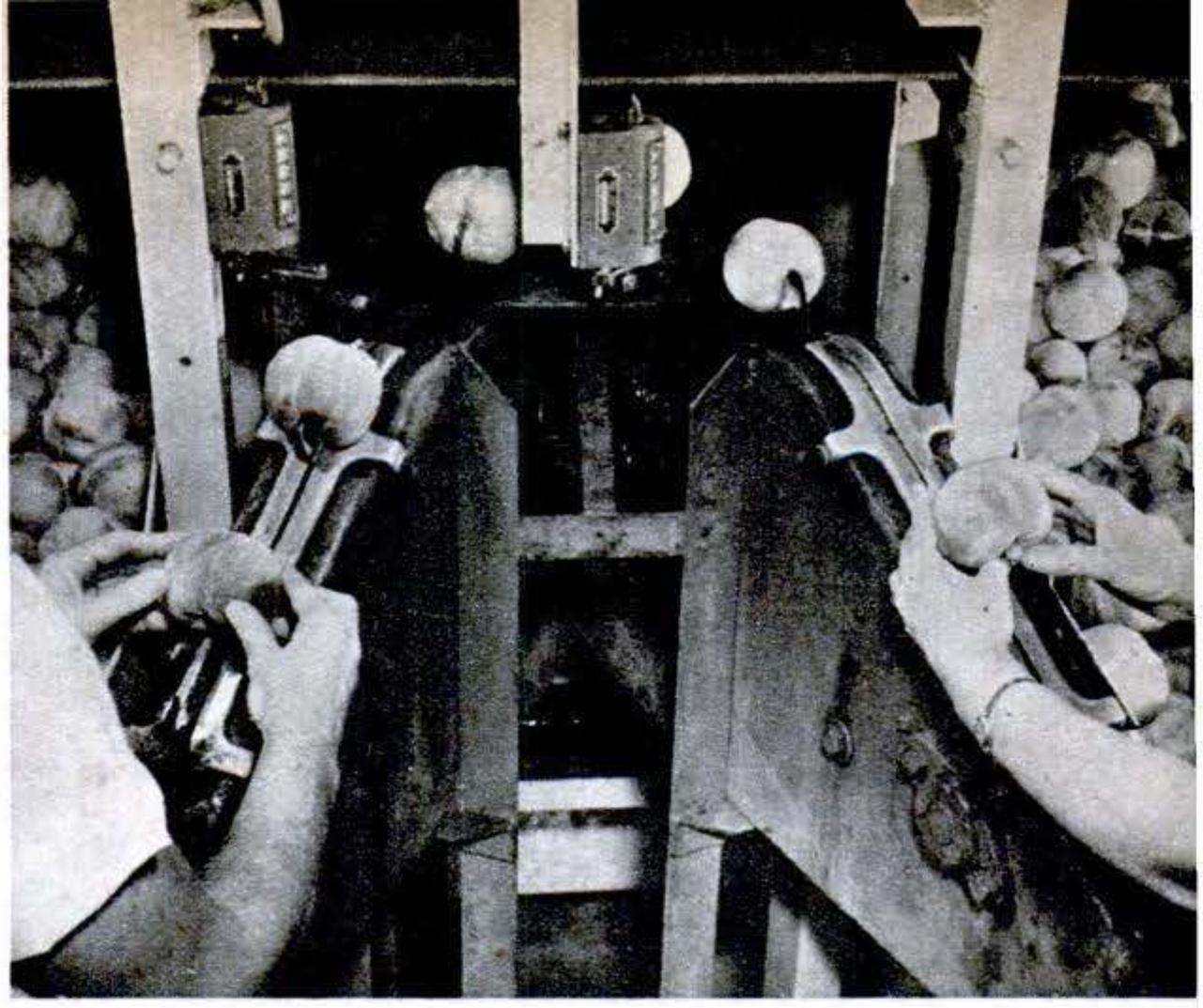
Cans Move Through Cooker

The cans worm their way toward the exit in a revolving reel. Eighteen minutes later, having cooked at 220° F. in a steam bath, they roll through another revolving door into a cold-water bath. To keep the hot cans from bursting, 25 pounds of air pressure is maintained in the cooler. Dried in a hot air tunnel, they are then labeled, packed in cartons, and rolled along a portable conveyer into a freight car.

That's only one of the most spectacular of the new food-processing robots.

In Rochester, N. Y., the Boutelle Manufacturing Co. has perfected a machine that will pit freestone peaches without ruining their tender meat. Across the nation, a California company has produced the Fill Master®, a machine that fills 350 cans a minute with whole-grain corn, peas, and similar products. The Central Machine Works, of Philadelphia, and the Pfaudler Co., of Rochester, N. Y., have come up with similar machines that cram such semiliquids as creamed corn and apple sauce into jars or cans through multiple nozzles at the same rate.

And no longer is oil simply poured over



Peaches, after being forced onto razor-sharp blades by hand, ride into a pitting machine. Opposing cups pick up the fruit and feed it past a thin saw that splits meat and pit in half. Cuplike knives then lift out pit halves.

sardines. A vacuum-controlled oiler, devised by the King Sales and Engineering Co., of San Francisco, to suck oil among the little fishes, cuts as much as four months from the soaking time formerly required.

Until recently, most frozen foods have been chilled in tunnels that work like your home refrigerator. Because air is a poor conductor, the process is slow. It also requires considerable labor. Entirely different is Food Machinery's continuous freezer, illustrated on the opposite page. It turns out 85 packages of fruit or vegetables a minute.

Juice Frozen in Cans

Storage and transportation costs are being reduced by concentrating fruit juices to a fourth their normal bulk. Yet this is done so that they become palatable drinks when their water content is restored. At Dunedin, Fla., an ingenious tunnel built by the Salem Engineering Co. freezes solid 10,000 six-ounce cans of concentrated orange juice an hour. Soon even segments of frozen fresh oranges and grapefruit will emerge from the big robot chiller in carry-home cartons—ready to be unchilled for fruit cocktails.

In other machines, just around the corner, cans will be dunked directly into refrigerants. Low temperatures rather than sterilization will preserve their contents. Production depends upon making sure that no refrigerant can leak into the cans.

More and more labor-saving inventions are on the way to bring you tastier foods and pack them so they are more appealing on your plate.

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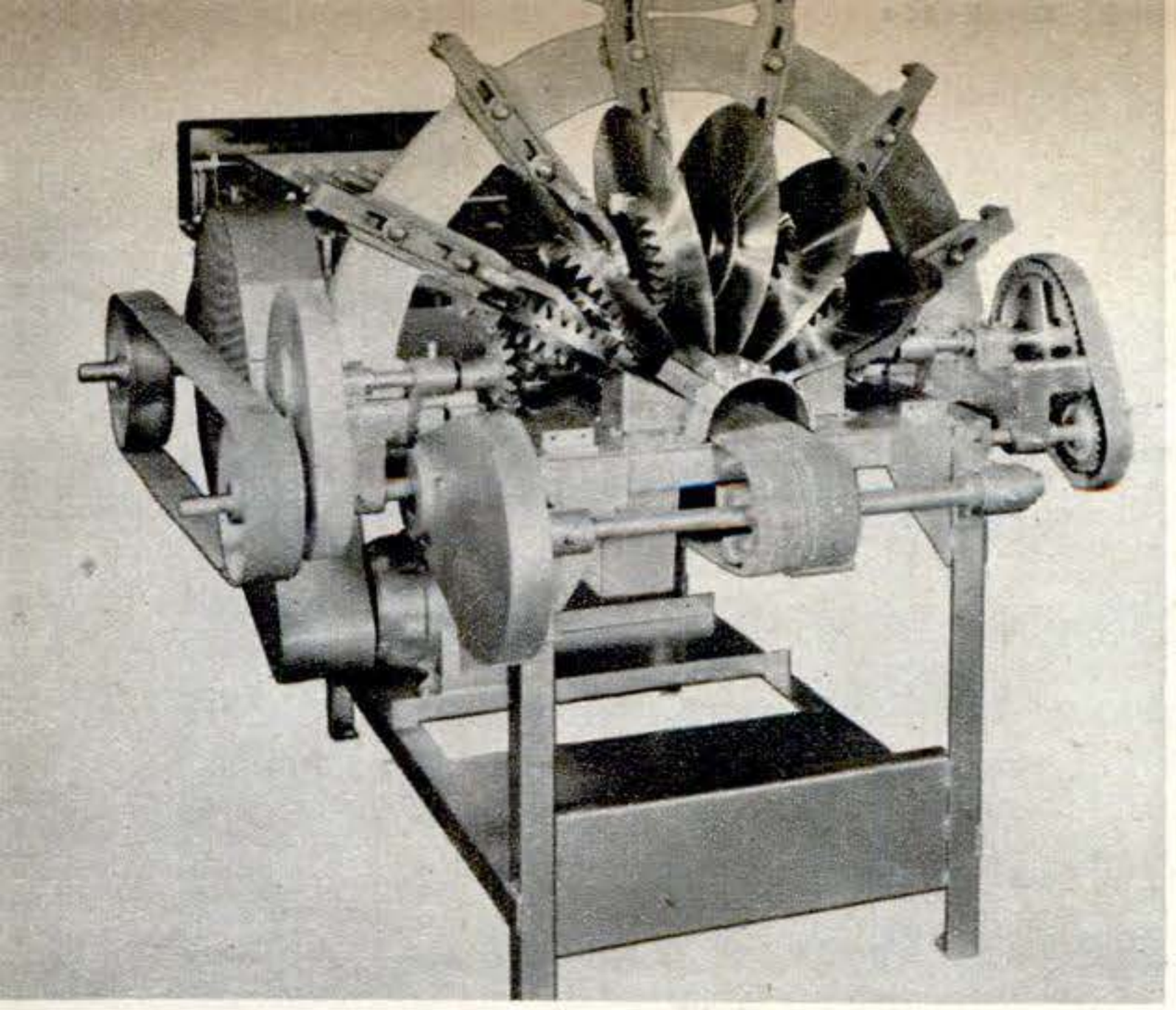
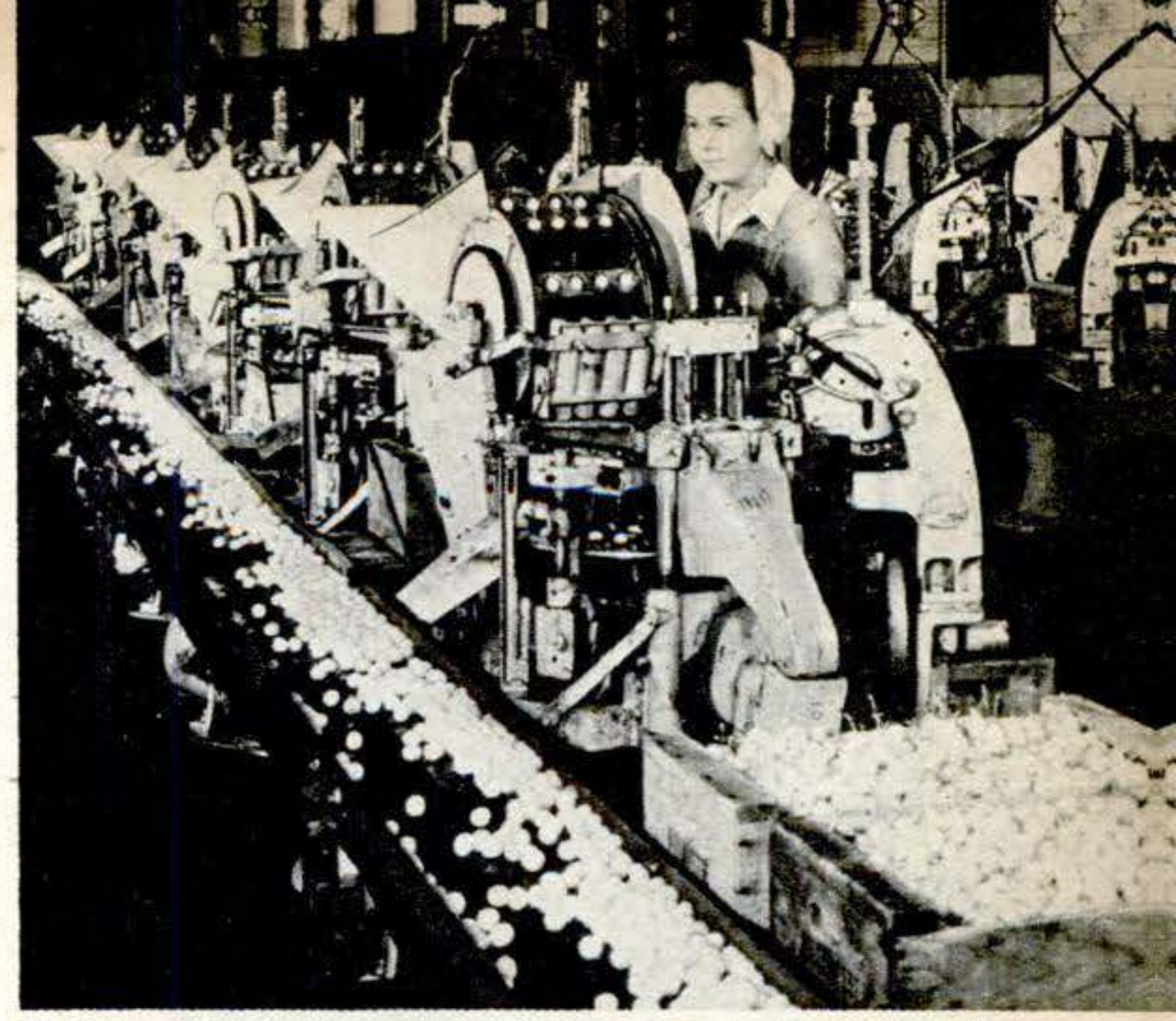
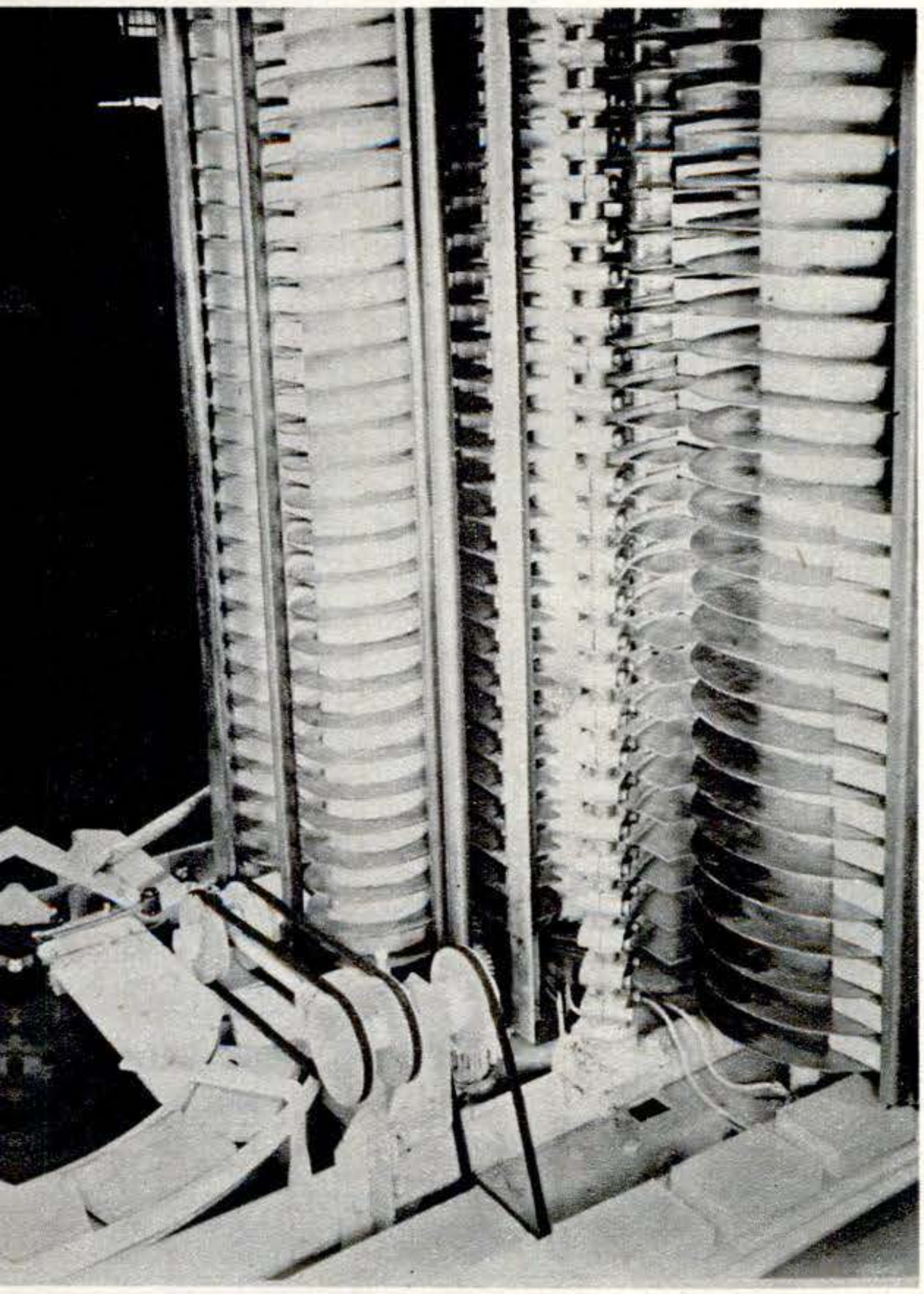


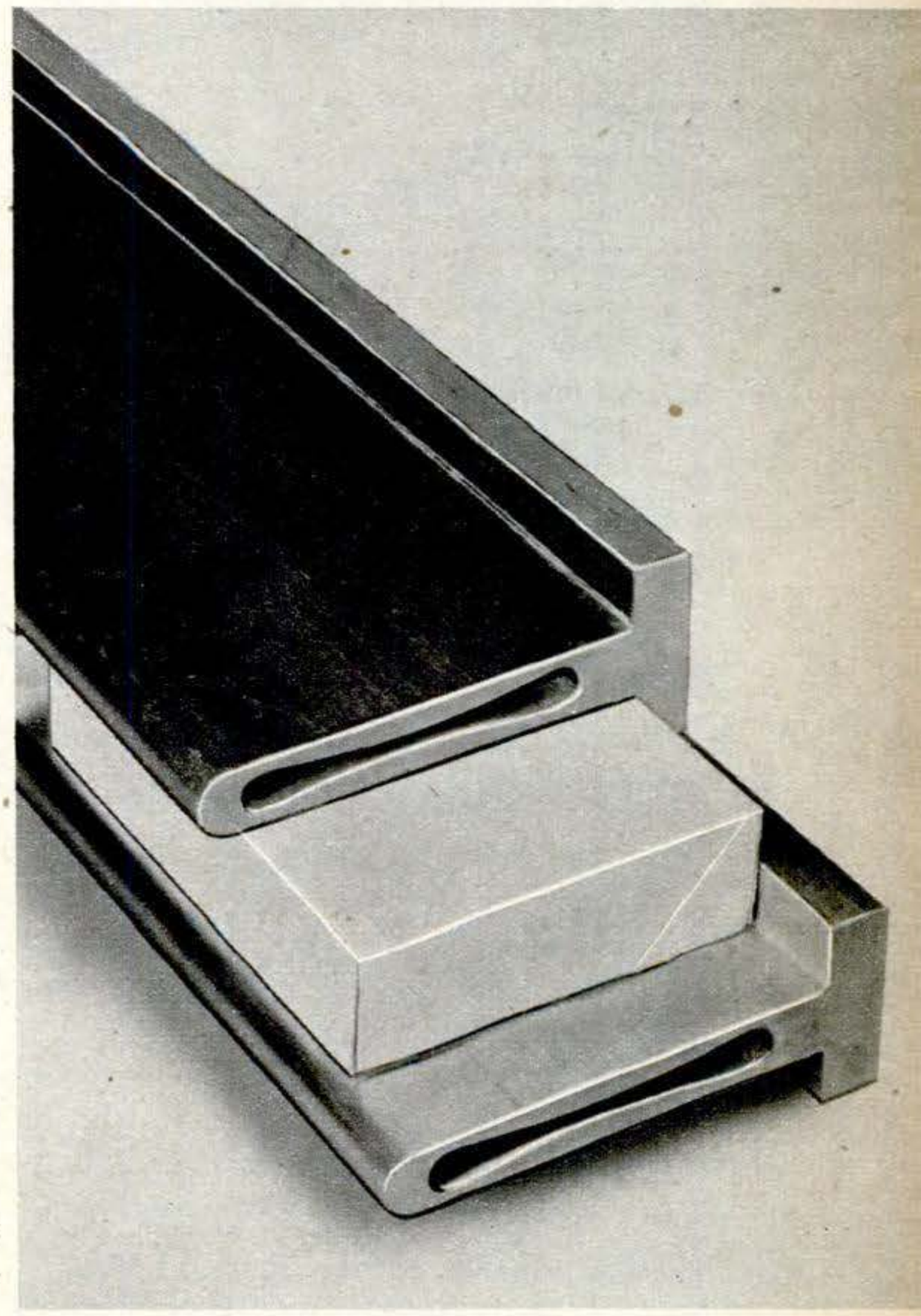
Emerging from a peeling machine, many peach halves go to this slicer. An automatic device places each half, cup-side down, on a belt. Spring fingers force the halves under six geared knives that cut each one into seven slices.



Taking the pits out of cherries is the job of this machine. After removing the stems, a steel plunger forces the pits out. A soft-rubber cup then pushes the torn meat back into place—leaving the fruit looking intact.



Packaged foods enter a continuous freezer along curved feed channel at lower left. Inwardly rotating screws lift packages into a vertical stack of 64. Guide bars push them between refrigerated plates inside the freezer. As they complete freezing circuit, another screw conveyer brings the frozen foods down to discharge line at lower right. The new machine saves time and labor.



Sectional view shows hollow aluminum rails or shelves that form freezing walls through which packages are shunted inside continuous freezer. Cold liquid ammonia (−28° F.) is pumped through dumbbell-shaped interior channels in rails. Food cartons, in direct contact with the chilled metal, freeze in one hour for dry items, up to 75 minutes for fruits in syrup.

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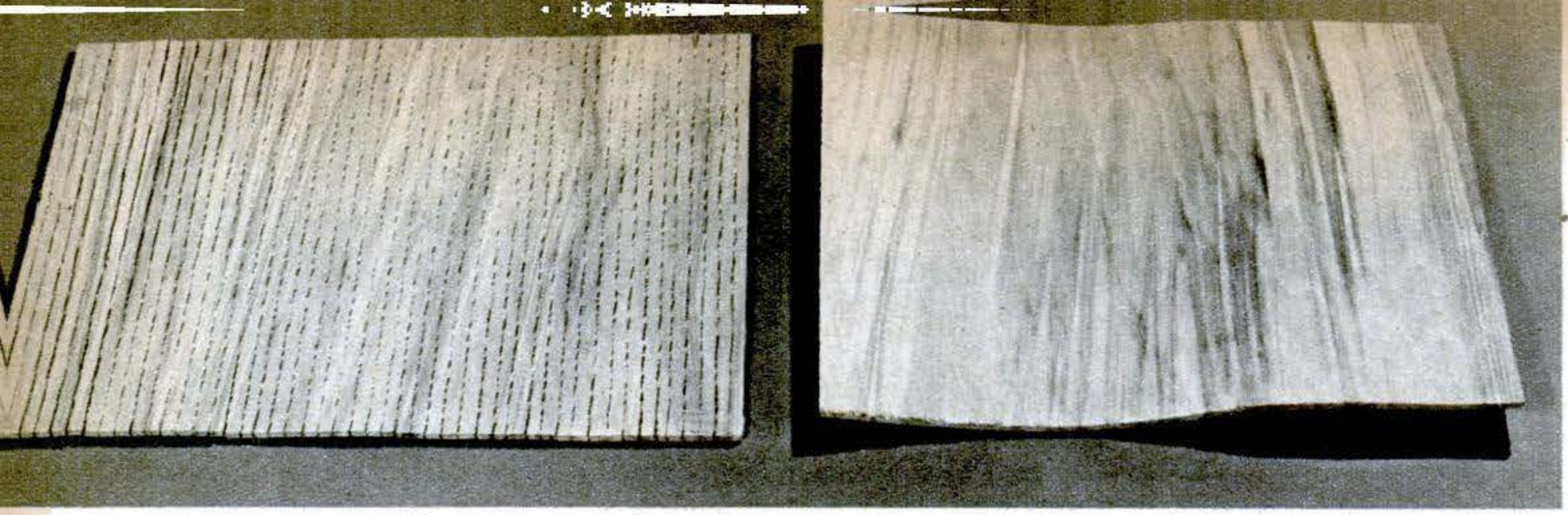
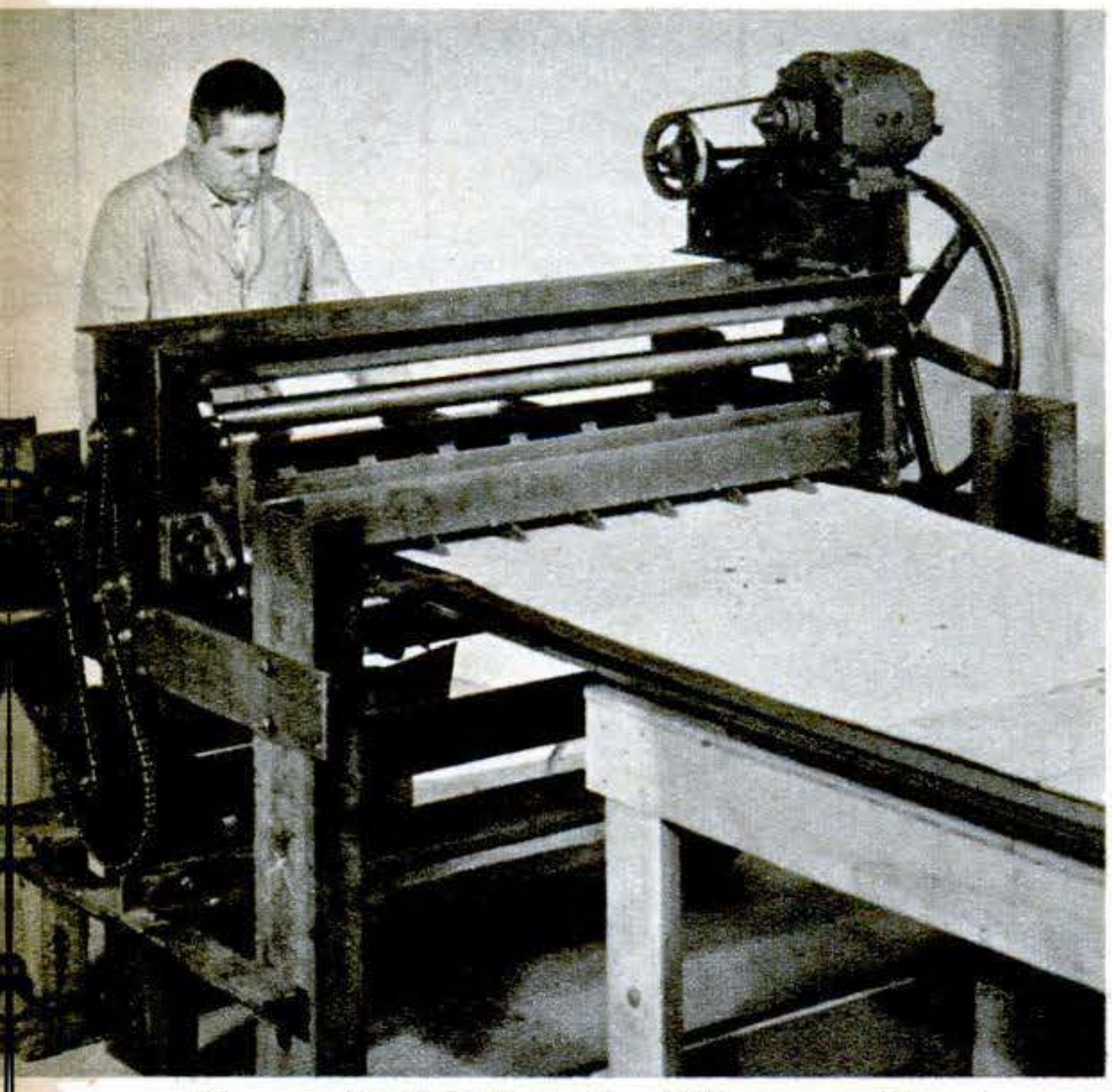


Slit veneer, at left above, remains smooth and flat, while uncut sheet at right warps badly.



Veneer is fed through slitting machine in continuous strips, while guillotine-like blade makes short cuts every ½ in. with the grain, leaving connecting fibers to hold the board together.

Slit-Sheet Veneer Saves Waste Wood

BY SPLITTING it thousands of times, waste wood has been turned into useful, money-saving wallboard. Called K-Veneer®, it is particularly adapted to prefabricated walls or sheathing. And it's said to be stiffer and stronger than insulation or gypsum board, or ¼-inch plywood as usually used.

Logs unsuitable for regular plywood—too small, too knotty, or of inferior species—are peeled into sheets, then run through a slitting machine (left). The slitting takes out no wood, but stretches the board, increasing its width up to 10 percent. This gives room for the wood to expand internally, when absorbing moisture, without warping.

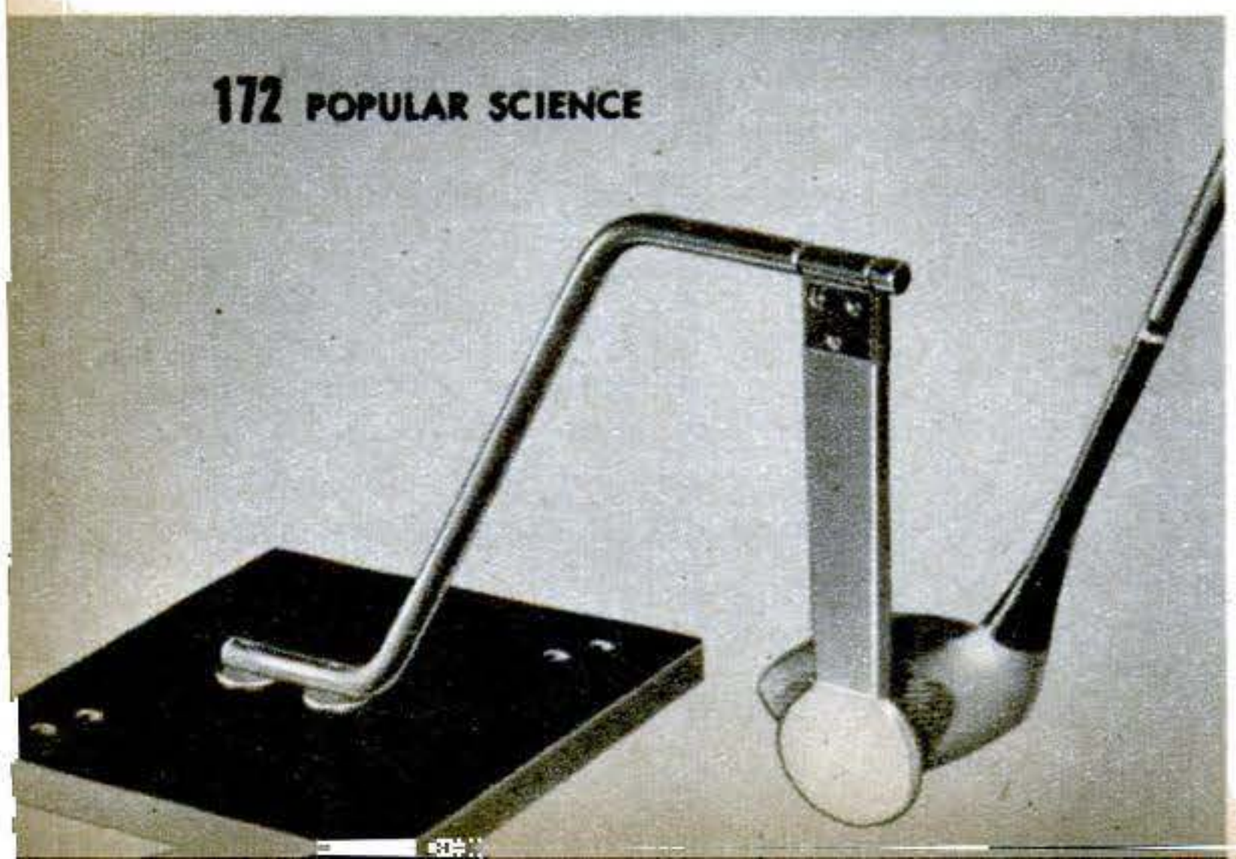
Once slit, the sheets go to a press. If for interior use, they are bonded to kraft liner board. For exteriors, they are faced with mineral-surfaced felt, thin steel, or aluminum sheets. K-Veneer has been developed by the Elmendorf Corp., of Chicago.

Driving Range Works Indoors

WITH the practice tee shown below, a golfer can start spring training indoors. The "ball" is a rubber pad on the end of a pendulum hung from the S-shaped arm. Thus the tee resets itself after each drive. The metal base may be bolted to the floor or weighted down. The device, made by Healthways of Hollywood, sells for $2.50.

Squirt Can Douses Fires

BEING demonstrated below is a low-cost fire extinguisher intended mainly for farms, where several might be kept handy in outbuildings. The Hero®, sold for $1.29, contains 16 oz. of carbon tetrachloride under pressure. Lifting a ring at the top snaps the tip off a spout—and out shoots a fire-dousing stream that carries 18 feet.



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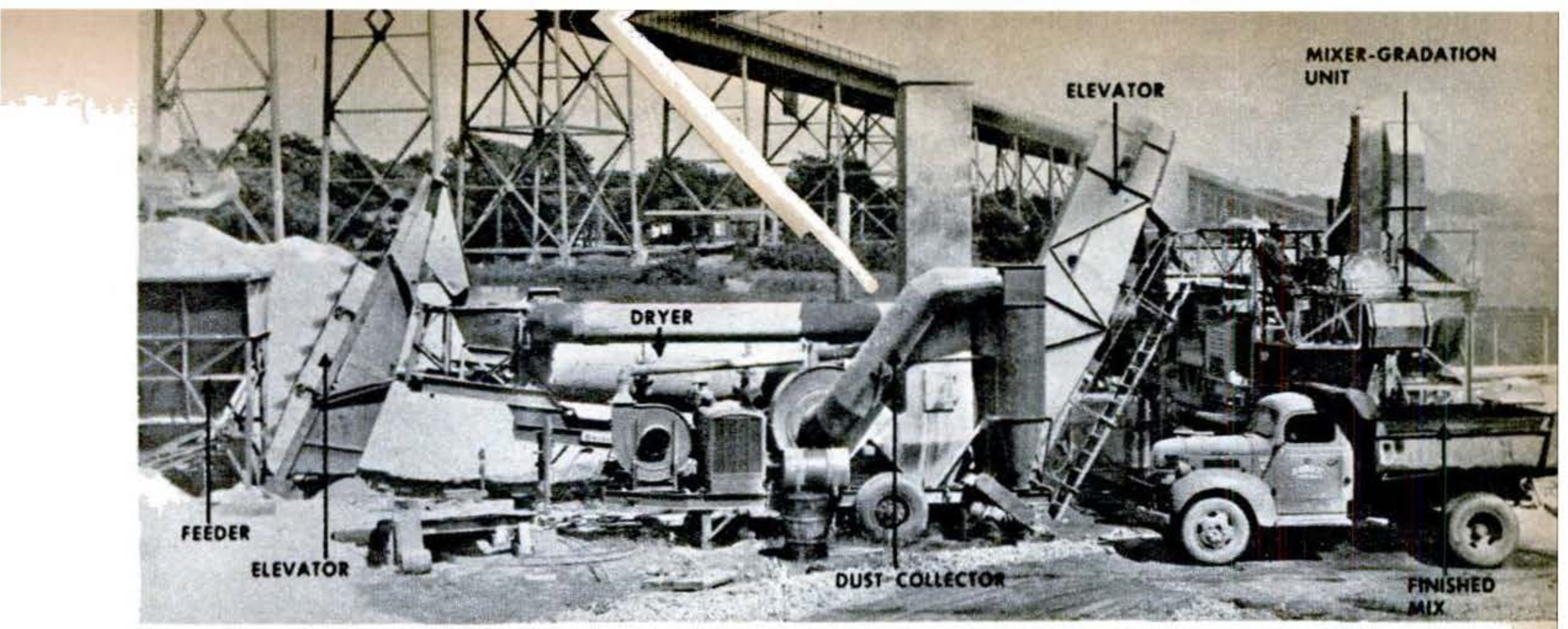


Utility asphalt plant is shown set up and in operation. The bucket conveyer at left loads crushed stone into one end. At the other, the completed mix is dumped hot into waiting truck.

Asphalt Plant Rides to Job On Trailers

WITH this trailer-mounted bituminous mixing plant, road builders can now make their surfacing material right on the spot. Its units can be hauled over the road to the project, set up, and later dismantled in minimum time. Yet the ingredients it uses are precisely measured and the process kept under exact control.

Origin of the portable plant goes back to World War II when roads had to be built in remote corners of the world. With this latest improved model, which turns out 60 tons of mix an hour, the crew can get the plant running in a week, plus a day for calibration. The plant is made by the Barber-Greene Co., of Aurora, Ill.

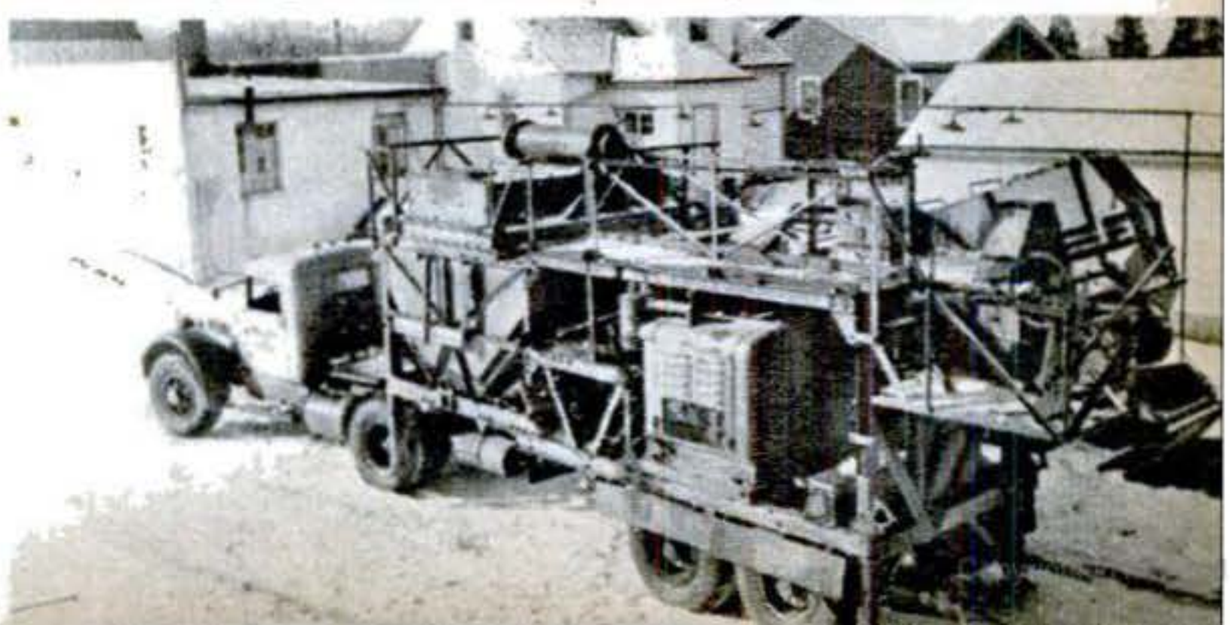
Dumped into the feeder, sand and crushed stone are carried automatically to the dryer, which cooks them at temperatures up to 400° F. This drives out moisture and makes the rock ready to stick to the asphalt. A dust collector reclaims 85 percent of the fine material that is blown off by the exhaust gases of the heating unit.

Meantime, a second elevator carries the heated stone to a bin, where screens sort out the right sizes for the kind of mix desired. Here limestone dust can be fed in for smoothness. Hot liquid asphalt is then added to the screened rocks to bind together the mix, which pours from a spout into trucks.

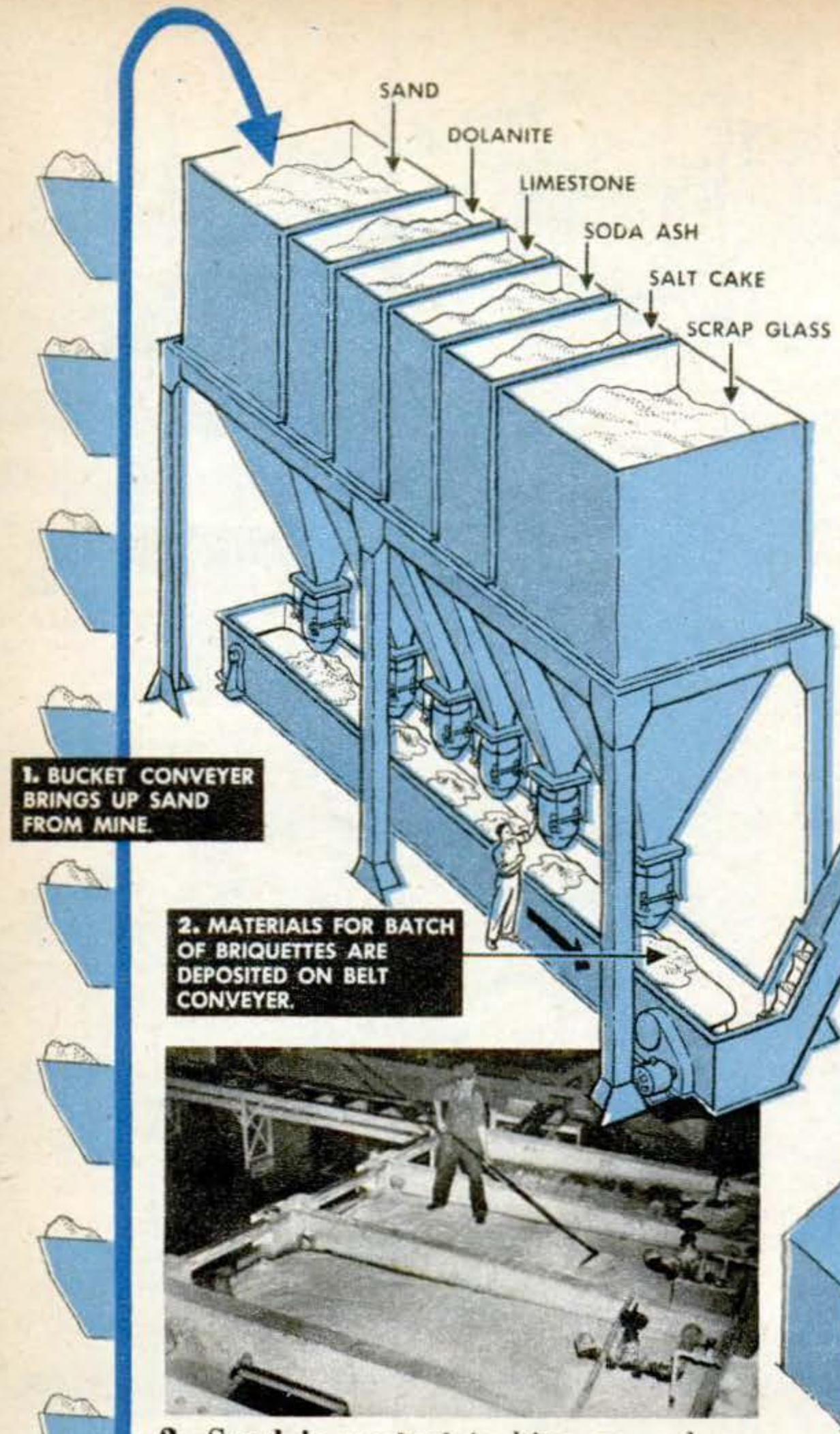
Aggregate dryer weighs about 27,000 lb. Finned interior of long drum rotates material as it is transported through heat from high- or low-pressure oil burner. Diesel engine supplies power.

Dust collector catches dust from dryer's exhaust gases. When used with high-pressure burner on dryer, no blower is needed, but one is hooked on for use with low-pressure burner.

Mixer-gradation unit sorts aggregate, makes sure that exact amount of the right sizes is mixed with the exact amount of liquid asphalt to make proper mix. Belt conveyer is built-in.



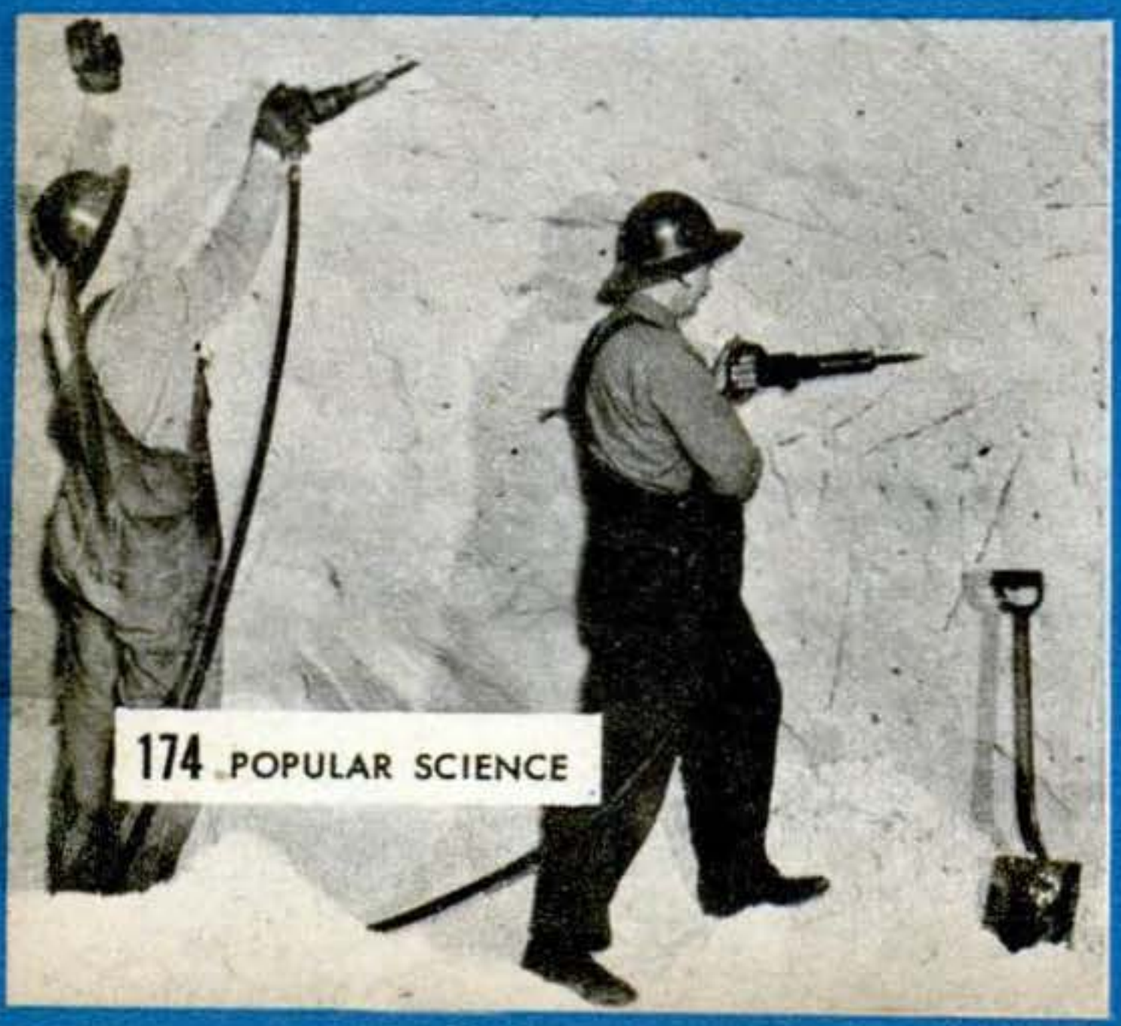
2-Man Mine



2. Sand is washed in bins as workman stirs it with hoe. Result is 99.65-percent-pure silica, basic ingredient of glass. This is heat-dried until it runs freely, like sugar.

3. Thick ribbon of soft, viscous glass is drawn from vat by knurled rollers in foreground. Vat holds 600 tons of liquid glass, produced by melting silica briquettes and scrap glass at 2,750° F.

1. In tunnel under glass factory, full crew of two men uses pneumatic picks to loosen sand, which they then shovel into cars that carry it to foot of bucket conveyer.



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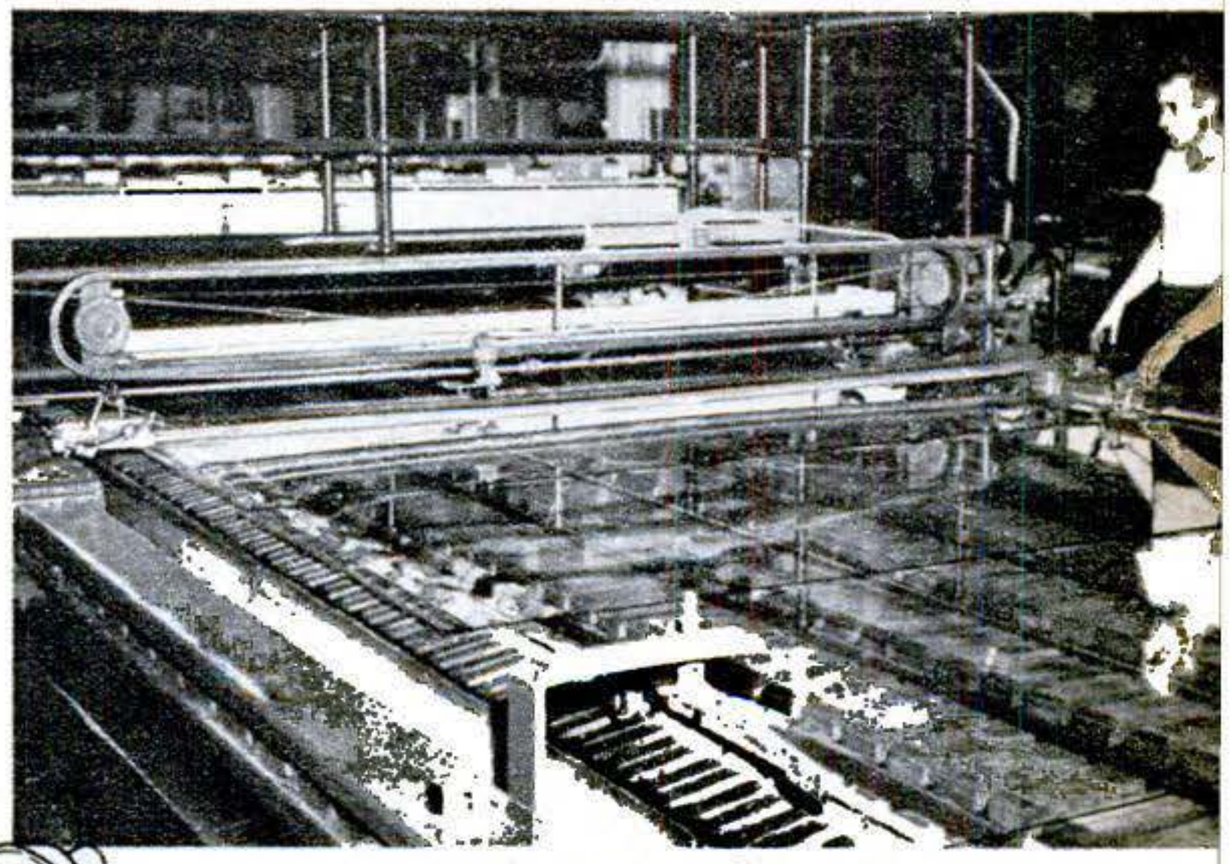
Feeds Huge Glass Plant

TWO men in a sand mine, digging with pneumatic picks and hand shovels, provide all the basic raw material from which this modern glass factory, 102 feet straight above their heads, produces more than an acre of sheet glass a day.

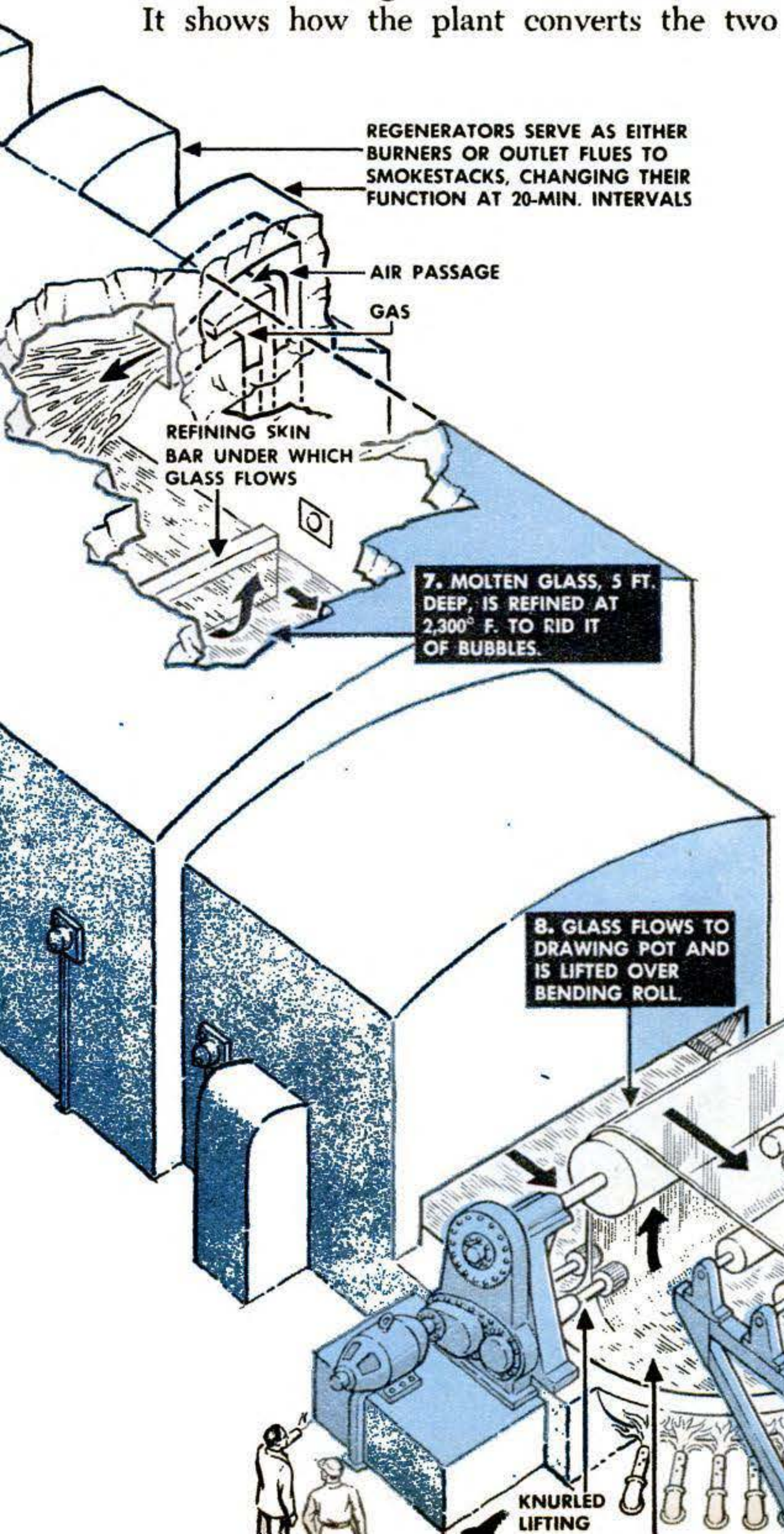
Working only five eight-hour days a week, in fact, they dig enough snow-white silica sand to keep the plant operating around the clock on a seven-day week.

The drawing is a simplified version of the Ford Motor Co. glass mill at St. Paul, Minn. It shows how the plant converts the two miners' output, brought up by bucket conveyer and mixed with other ingredients, first into briquettes and then into a continuous ribbon of glass, 104 inches wide, that rolls out of a long annealing oven at the rate of more than a mile a day.

4. Glass cools slowly from 1,100° F. to 140° on trip through this 175-ft.-long annealing oven.



5. Cutter slices glass into sheets by zipping across strip at 5-ft. intervals.



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Gus Runs into Twin Trouble

In the Spring a young man's fancy may turn to thoughts of blondes,
but an extra blonde and a balky engine can complicate matters.

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By Martin Bunn

"HEY, BOSS!" Stan Hicks shouted as he bounced into the Model Garage. "It's here."

Gus Wilson pulled his head from under the hood of a sedan. "Now what?" he asked.

"My new car," Stan beamed. "It's right outside the door. Ready for me to drive."

"That's fine," said Gus. He pointed to the sedan he'd been working on. "Now these cylinders . . ."

"And just in time, too," Stan cut in. "I'm taking Spick to the city tonight for a movie."

"Spick?" Gus asked. "Who's Spick?"

"Spick Smith—her name's Mary but everybody calls her and Susan—that's her sister—Spick and Span."

"Oh, those twins," Gus remembered. "I can't ever tell 'em apart."

"I can," Stan boasted. "And how."

"Okay," said Gus. "Now these cylinders..."

"Spick's a good-natured gal," Stan went on. "But Span—that's Susan—is always throwing a rod about something. She's scrappy."

Gus began again. "Now these cylinders..."

"That reminds me," said Stan. "I guess the dealer must have sold my old bus for what I asked. It's a good thing you helped me with that overhaul we gave it." Stan couldn't curb his excitement over the new car.

"Yeah, I guess so," said Gus, "but these cylinders . . ."

Stan looked hurt. "Gee, don't you want to look at my new car?"

"Oh, sure," Gus grinned. "I was just going to suggest that." They walked out of the shop to a gleaming convertible.

"Snappy, hey?" said Stan.

"Looks swell, Stan," Gus told him. "You'll be a real hot shot, driving that."

Enter Two Blondes

Gus and Stan looked up as a horn snarled and a pre-war sedan was braked to an abrupt stop beside the convertible. Out of the front seat hopped two girls. Both were strawberry blondes. They looked exactly alike and they were dressed exactly alike. But there the sameness ended. One smiled sweetly at Stan. The other glared at him.

"Why, Spick," Stan stammered, "what're you doing in my old car?"

Just then there was a wheeze and a roar

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from the sedan's rear seat as a man pulled himself out the door. He was middle-aged, stout, pompous, and obviously angry.

"This is an outrage," he thundered. "A dastardly outrage. If I do not obtain satisfaction—complete satisfaction—here and now, I shall take steps. Drastic steps. I shall file a complaint in the proper quarter and I shall press that complaint to a conclusion—a bitter conclusion for the man who has taken advantage of the innocence and trust of an inexperienced young girl."

Gus shot Stan a quick look. "Hey," he whispered, "what you been up to?"

"I ain't been up to anything," Stan yelped.

The girl who had been smiling began to giggle. The one who had been glaring turned the glare up a couple of notches. The man sputtered. Gus looked puzzled.

Mr. Smith Sounds Off

"What – what's the matter, Mr. Smith?" Stan asked weakly.

"Matter! You know full well what's the matter," Smith roared. "I want a definite answer. No evasion. Yes or no." He jabbed a trembling forefinger at Stan's old sedan. "Were you or were you not the owner of this –this wreck?" he demanded.

"What do you mean—wreck?" Stan bristled. "That's a good car—for its age. Yes, I did own it. I told Sniffen and Company to sell it for me so I could buy a new one from them. What's wrong with that?"

"Ha!" Smith almost screamed. "So you admit it. Now did you or did you not tell Sniffen and Company that the car had been thoroughly overhauled at the Model Garage and that it was in first-class operating condition. Yes or no?"

"Of course I told them that," Stan snapped. "And it was true, too."

"True?" Smith howled. "My daughter – poor, deluded girl—trusted you. And it was on the assurance of the salesman that you had placed the car in perfect condition that she purchased it."

"Well, it was true," Stan repeated.

"Perfect mechanical condition," Smith sneered. "Listen." He clambered into the car and pressed the starter button.

The starter ground for some moments and when the engine finally caught it ran so roughly that it shook the car.

"Perfect mechanical condition," Smith continued to snarl. "The engine won't start half the time and if it does it sputters and bucks. And that isn't the worst of it." He turned the switch, climbed out of the car, and slammed up the hood. "Look," he pointed dramatically.

Stan and Gus looked. The firewall was sticky with oil and a grimy film of it seemed to coat the entire engine compartment.

"Oil—oil all over everything," Smith rumbled. "And the waste of money. It eats up two quarts in a hundred miles."

Papa Smith seemed about to run down. Apparently the blonde with the double-duty glare thought so because she took over.

"All I've got to say," she snapped, " is that I don't think much of people who go around selling other people beat-up old autos."

"Aw, now listen," Stan began.

"You're always talking about what a great mechanic you are," she went on, "but when this car went bad on you the only thing you could think of doing was to stick somebody else with it so they'd have all the trouble and, furthermore, I don't ever want to have anything more to do with you . . . you . . ."

"Amazing," said Gus, "all in one breath."

The girl threw him a sharp look and acted as if she were about to take off again.

"But, listen," Stan said and then broke off with a shrug. "What's the use? You never listen to anything because you always want to do all the talking." He turned to Gus. "What happened? You know there wasn't anything wrong with it when I took it to Sniffen's."

"That's right," Gus agreed. "It was in good condition—a good buy at the price."

Gus Sounds Off

"Ha!" There was a note of triumph in Smith's voice. "So the Model Garage admits its responsibility."

"The Model Garage isn't admitting anything," Gus told him. "We're not in the used-car business. That's why I asked Stan to have Sniffen sell the car for him instead of selling it himself. The Model Garage has no responsibility in this deal."

"We'll see about that," Smith put in.

"But," Gus said, "I helped Stan put the car in first-class condition before he offered it for sale. There wasn't anything wrong with it when it went out of this shop and there's nothing wrong with it now."

Smith held his head with one hand, pointed to the old car with the other, and whispered hoarsely: "Nothing wrong, he says."

"That's what I said," Gus laughed. "Drive the car in the shop, Stan." The Smiths started to follow, but Gus stopped them. "If you'll come back in fifteen minutes, I'll have the car ready for you. There'll be no charge."

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Stan watched him take something from a coverall pocket and quickly slip it under the hood.

"I'll stay right here," Smith shook his head, "and see what you do. Make sure there's no monkey business this time."

"I'm running this shop," Gus said, "and I don't allow visitors during working hours. You can wait in the office if you like. If you don't want to—well, I've other things to do."

"Let's wait," said the twin who had been smiling. "I'm sure Mr. Wilson will make good his promise." Her father grumbled but he and the other twin followed her into the office.

"I got rid of them to save your face," Gus grinned at Stan as the office door closed.

"Huh?" Stan started to object.

Gus Pulls a Fast Switch

"Step on it," Gus said. "Wipe the oil off all the wires and spark plugs and off the distributor and rotor. Clean out the distributor. Then slip in a new set of points. Watch the clearance."

As Stan finished the cleaning job, Gus came over to the car. Stan saw him take something from a coverall pocket and slip it quickly under the hood.

"What're you putting in there?" Stan asked.

"Never mind that now," Gus said. "Call your girl friends and their pa."

Gus looked at the twins with a puzzled frown as the Smiths paraded into the shop. "Who bought Stan's car?" he asked.

"I did," said the one who had glared.

"Okay," Gus said. "Start it, please."

When she pressed the starter button, the engine took hold instantly and ran smoothly.

"That's better," she admitted, "but what about oil? I don't want to be buying a quart every few miles."

"You probably won't need oil for eight hundred or a thousand miles," Gus said.

"I'll believe that when I see it," she sulked. "I'm taking a friend to the city tonight. I'll see how it works then . . . Come on, papa."

Smith got into the car. Stan held the door for the other twin.

"I'll stop by at seven," he said. She looked at him. "Well, you're going to the movies with me, aren't you?" he asked.

She smiled. "Seven, then."

Stan turned to Gus as the car rolled out of the shop. "What's the score? What'd you put under the hood to stop that oil leak?"

"Know what this is?" Gus asked. He held out a cadmium-plated cap.

There Are Caps and Caps

"Sure," said Stan. "It's an oil-filler cap. Where'd it come from?"

"I just took it off your old car. Remember you mislaid the original cap when we worked on the car? Said you'd find it and put it on before driving to Sniffen's? Did you?"

"Gosh, I forgot all about it." Stan's face reddened.

"Apparently Sniffen's men put this one on," Gus said, "and it's the wrong cap for that model. Your car takes a combined filler cap and engine-breather cap. The engine couldn't breathe with this one. It didn't permit any crankcase ventilation. All that oil vapor was forced out around the rear main bearing and under the valve-cover plates."

"Gosh," was all Stan could mumble.

"The vapor even forced its way up the distributor-shaft bushing and fouled the distributor points almost enough to put the engine out of action. I found the cap you mislaid and as soon as I looked at that engine I knew what was wrong. You've been thinking too much about that pair of blondes," Gus joked.

"Only about one of 'em," Stan said.

"Which one?" Gus asked. "I still can't tell 'em apart."

"The nice one," Stan said. "Spick. Not the one that bought the car. That's Span."

That evening Gus was in the city. He was paying a parking-lot attendant when Stan drove up in his new convertible. A twin sat very close beside him.

"Hello," said Gus. "Hello, Miss Spick—like the show?"

"It was wonderful, Mr. Wilson," the girl smiled, "but I'm not Spick. That's Mary. I'm Span—Susan."

"Oh," said Gus. "But I thought Stan said—never mind. I can't tell you two apart."

"I can—now," Stan said, "but this afternoon I thought that Span was Spick and that Spick was—well, boss, you see how it is?"

"No, I don't," Gus grinned, "but anyway, it's your problem, not mine." END

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How Overdrive Works

Here are some little-known facts you'll find valuable if your car is equipped with this semi-automatic transmission.

Drawings by Stewart Rouse

WHEN you first take the wheel of a late-model car equipped with overdrive, you'll soon discover that some of your old driving habits don't quite fit. For one thing, you are used to judging car speed by engine sound. So you may scare yourself on the first curve. Or collect a few speeding tickets.

There's a reasonable explanation for this. Overdrive cuts engine speed 30 percent. Compared to the job it usually has to do, the engine loafs. Naturally, it runs more quietly, and you're apt to underestimate the speed at which you're traveling.

Automatic overdrive was introduced 15 years ago. Since then, two and a quarter million units have been manufactured and installed on cars. Yet, despite its long history and expanding use, there's surprisingly little understanding of how it works or what you can do with it. Many drivers think of it solely as a fourth gear for open-road cruising. But that's just part of it.

Reduction of engine speed is the basic idea behind all overdrive equipment. From this, you get two direct benefits—better gasoline mileage and longer engine life. In addition, you have *two* extra forward speeds and many of the conveniences of an automatic transmission.

Gasoline is saved because of reduction in the total horsepower required to propel the car. Tests with a stock car have shown why.

It was determined that 12 hp. was needed simply to move the car at 40 m.p.h., either in conventional high or overdrive. However, engine friction and power losses in driving engine accessories demanded an additional 18 hp. while the car was in conventional drive. In overdrive, since the engine speed is reduced, this figure was cut to 11 hp.—a saving of 7 hp.

Except for a new type recently announced for dealer installation on Chevrolets, all overdrive units now in production for current-model cars are made by the Warner Gear Division of Borg-Warner Corporation. In the Warner units, there are slight variations in the electrical circuits and external housings from car to car, but essential components are virtually the same. The accompanying drawings show the working principles of a typical late-model unit. For clarity, some parts are exaggerated.

A modern overdrive unit is a supplementary two-speed transmission. It's mounted directly behind the normal three-speed trans-

DID YOU KNOW?

- Overdrive adds two extra speeds to your three-speed transmission—overdrive second and overdrive high.
- Overdrive second permits you to drive in traffic without touching clutch or shift lever. After engaging second, you can shift back and forth between second and overdrive second simply by manipulating the gas pedal.
- Below cut-in speed, after the car's once in low, you can shift at will without the clutch. In shifting up, release gas pedal briefly.
- You can engage overdrive (push in control knob) at any speed.
- You can lock it out (pull out control knob) at any speed. Before pulling the knob, kick down the gas pedal.

A FEW CAUTIONS

- Always lock out overdrive on slippery roads or when descending a long hill.
- Don't try to lock up into conventional drive below the cut-out speed without first feeding a little gas. You won't cause harm, but the unit will make an alarming buzz.
- Don't try to lock up above the cut-in speed without first kicking down from overdrive. Until you do, the dash knob won't pull out.
- In overdrive second, stay below 50 m.p.h. to avoid excessive gear velocities. With older cars, don't exceed 35 or 40 in overdrive second.
- Leave the car in reverse when parked on a hill.
- When being pushed for a dead-battery start, lock up into conventional high.

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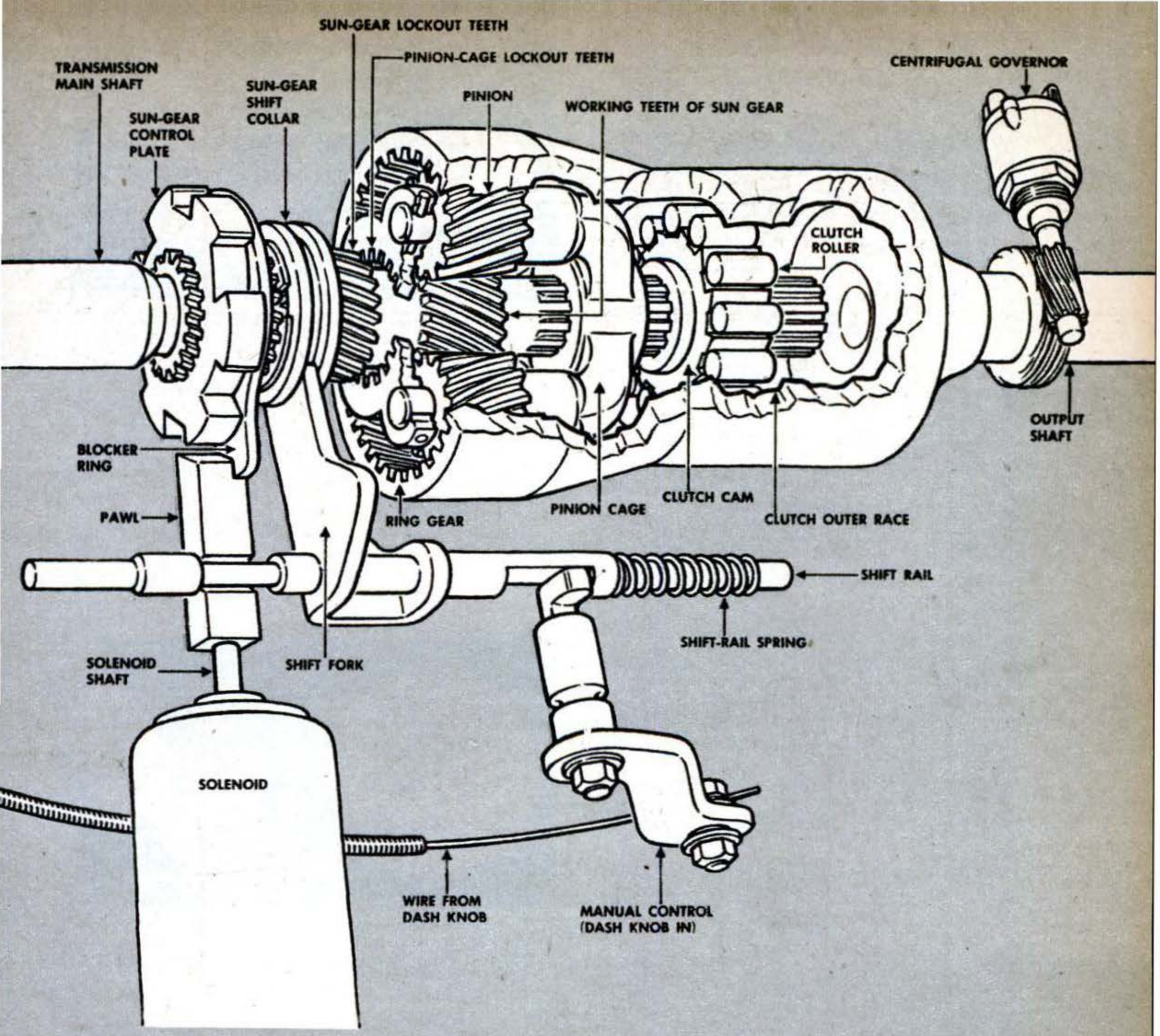
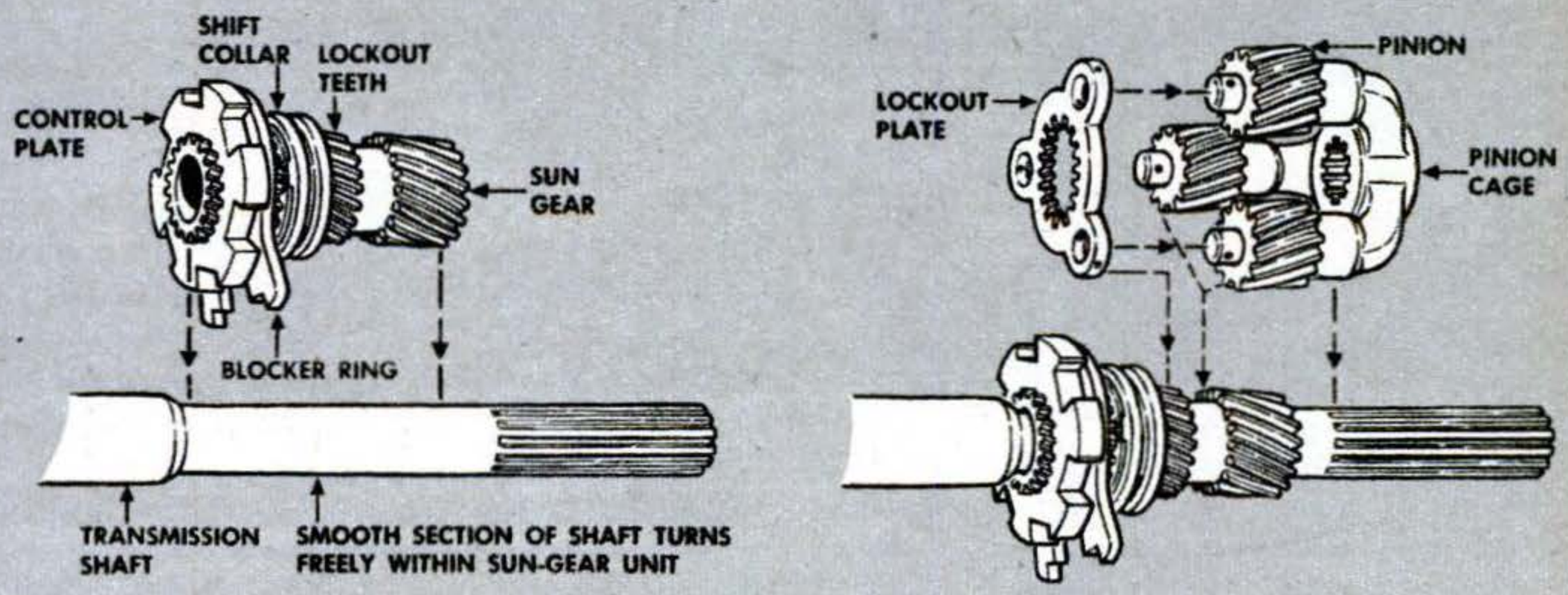


The parts of an overdrive unit are in the position above while car is at rest with dash knob in.



Planetary gears form the heart of overdrive. They give a ratio change that reduces engine speed in relation to car speed. The planetary set consists of a sun gear, three pinions that walk around it, and an outer ring gear. Entire sun-gear unit simply rests on smooth section of main shaft.

There's no driving connection between the two. Pinion-cage hub is splined to shaft. Hence, the pinions are constantly carried in a circular path around the shaft. The pinions transmit power only when overdrive is in use. For this, sun gear is held stationary.

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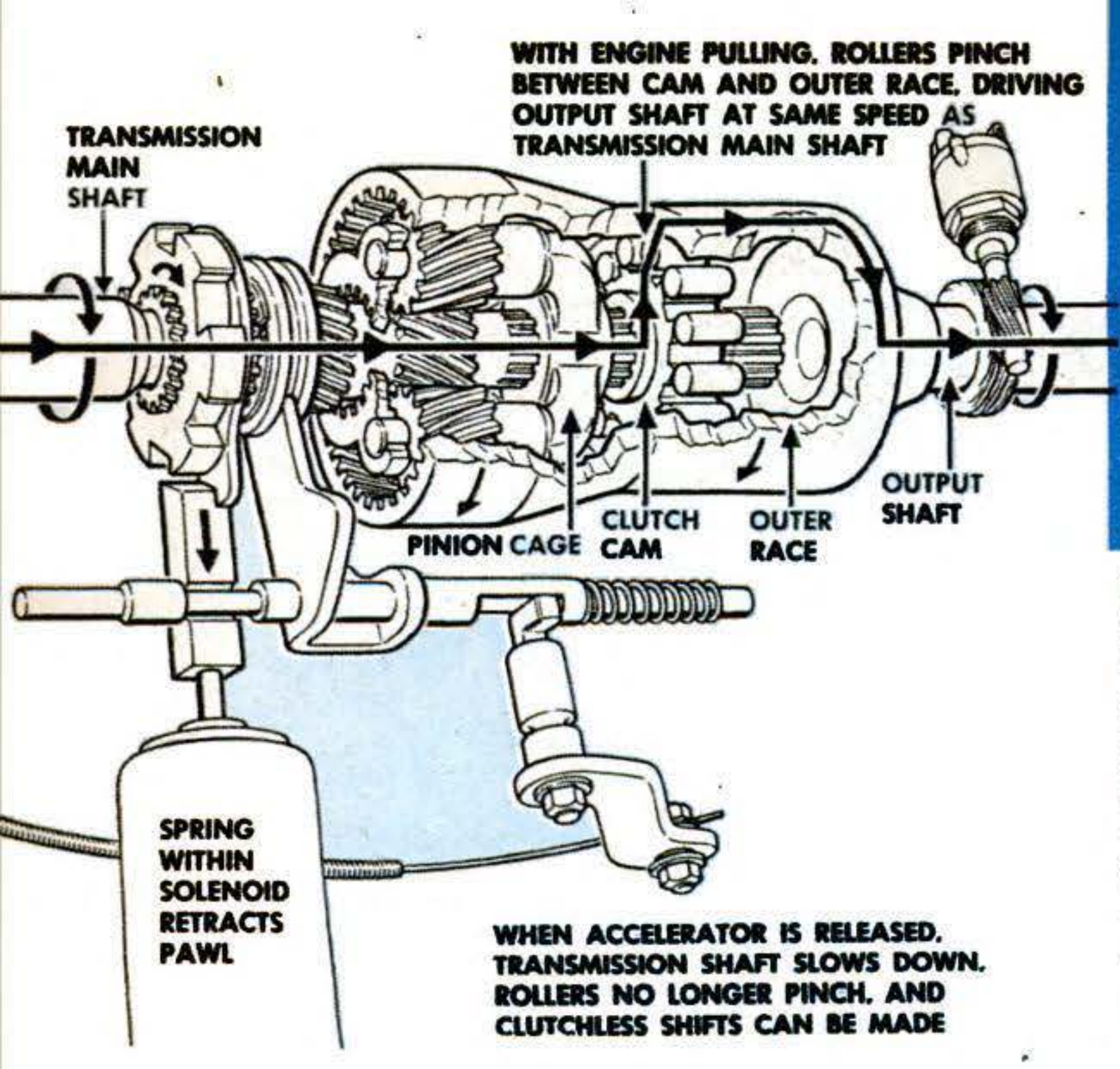
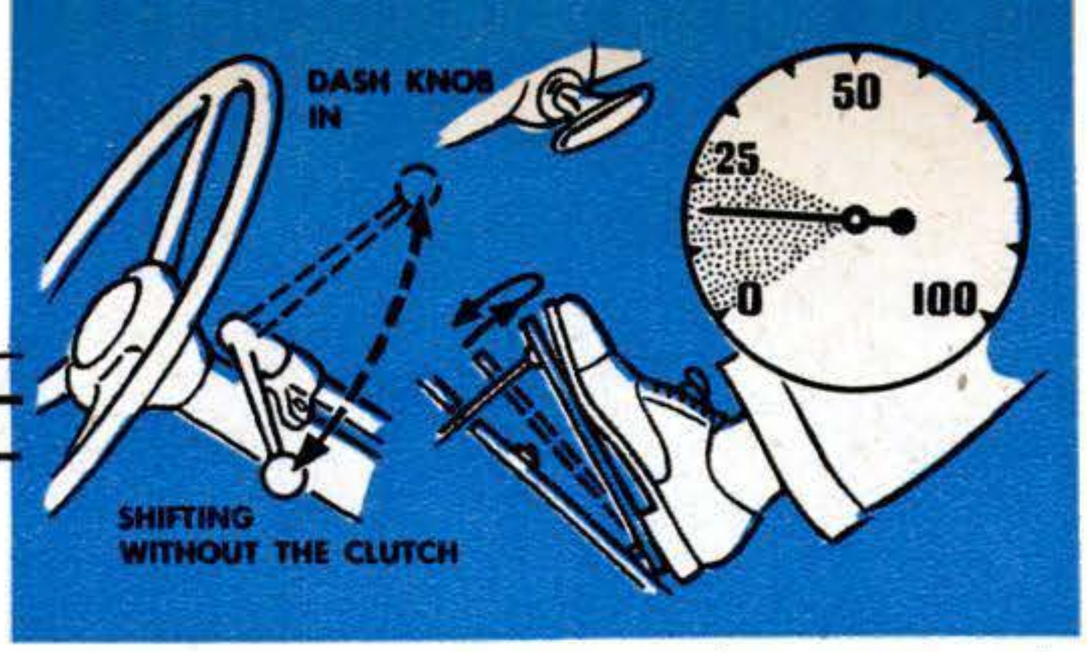
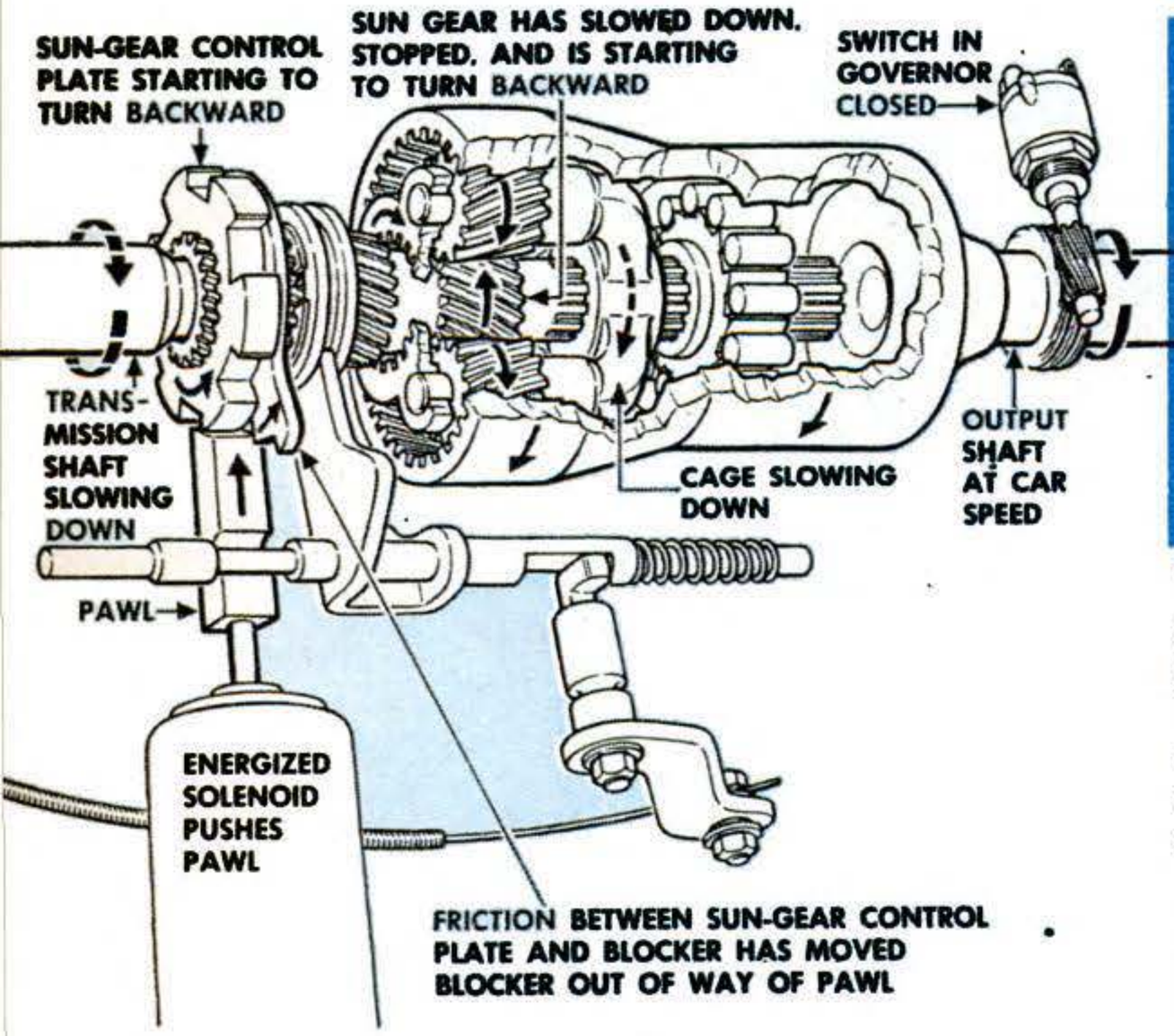
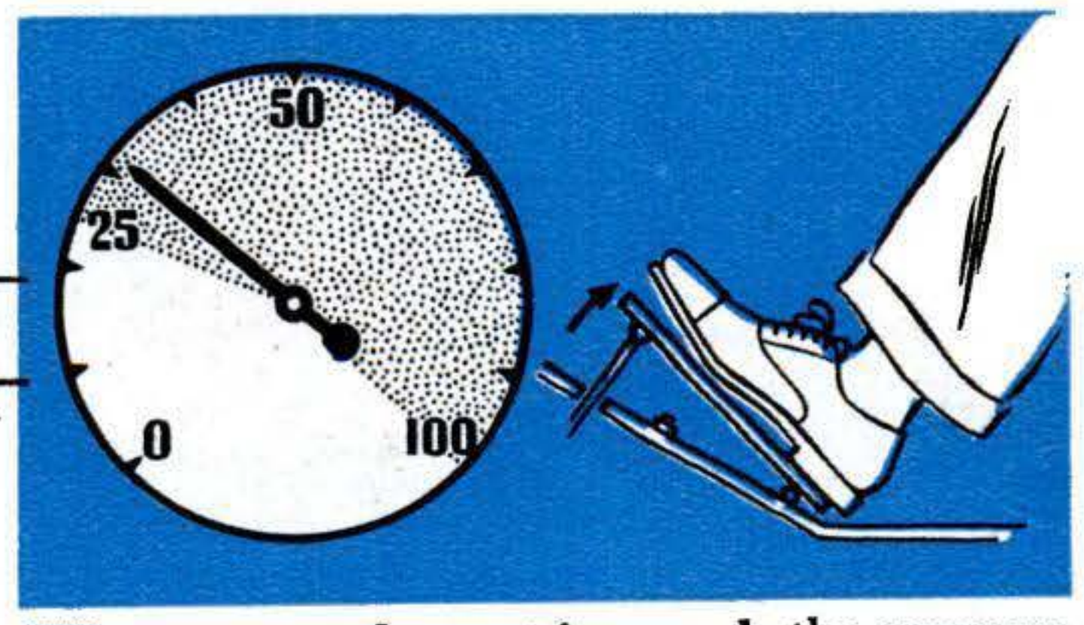




Let's see how overdrive works, starting out from standstill with dash control pushed in. Up to cut-in speed (25 m.p.h. here) drive is through the freewheeling mechanism. The transmission main shaft extends through sun gear and is splined into the pinion cage and freewheeling-clutch cam. As engine drives the cam through main shaft, rollers move outward into wedging contact with outer race, causing latter to rotate and deliver power to wheels. Let up on the gas and roller clutch releases, allowing shifts without the regular clutch.





When car reaches cut-in speed, the governor energizes solenoid and latter urges the pawl toward engagement with notched sun-gear plate. While engine is driving, blocker ring balks this engagement. When you let up on the gas, car momentum tends to drive engine. Reverse torque results. In fraction of second, roller clutch disengages, sun gear and plate slow, stop, and make slight backward turn. By means of friction, control plate carries horseshoe-shaped blocker ring backward too. This frees the pawl, allowing it to engage notched plate.

mission. Thus you have a total of five forward speeds.

In order of gear ratio, these are low, second, overdrive second, high, and overdrive high. There's only a little ratio difference between overdrive second and high, but overdrive second is nevertheless a convenience that some owners don't know they possess—an automatic gear for easier traffic driving.

This is particularly true in the larger-engined cars with overdrive units set to cut in at relatively low speed. With such a car, you can do all your traffic driving in second and overdrive second—without touching the clutch or shift lever. Second provides all the power you need; overdrive second gives you the speed.

The things you do to operate overdrive are few and simple. To place the mechanism in readiness for automatic operation, you push in the dash knob. You can do this while the car is at rest—or at any speed.

Starting from a standstill with the knob in, you shift into low in the usual way. From then on, *until you reach the overdrive cut-in speed,* you can shift into or out of any conventional gear without touching the clutch.

In shifting up, just release the accelerator momentarily while you change the gear lever. In shifting down, simply move the lever. A downshift from second to low is best done

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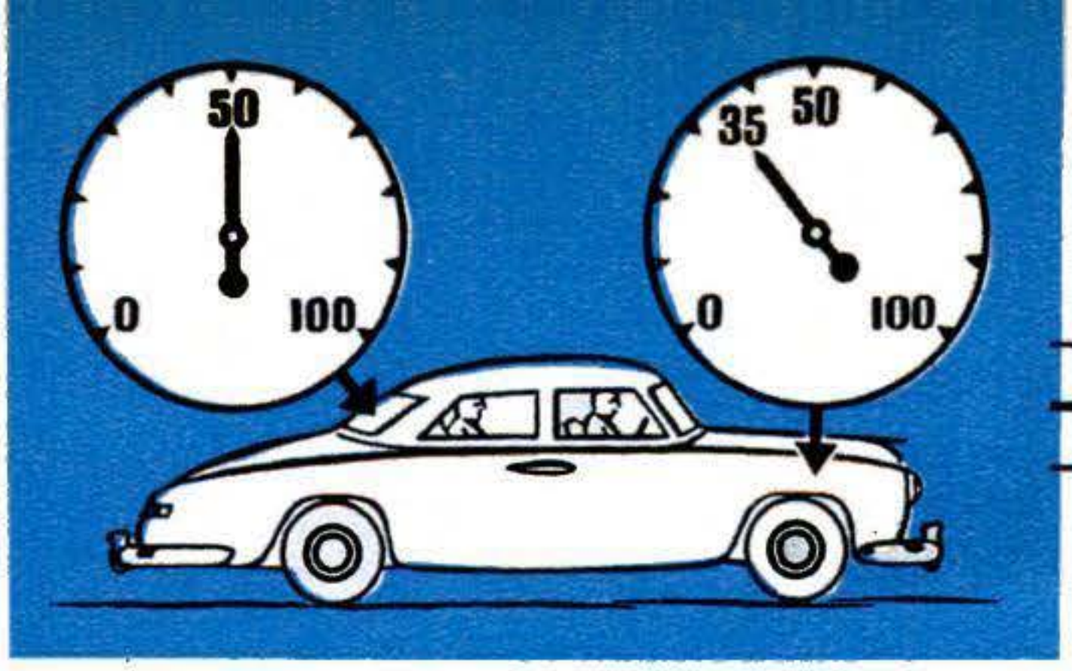
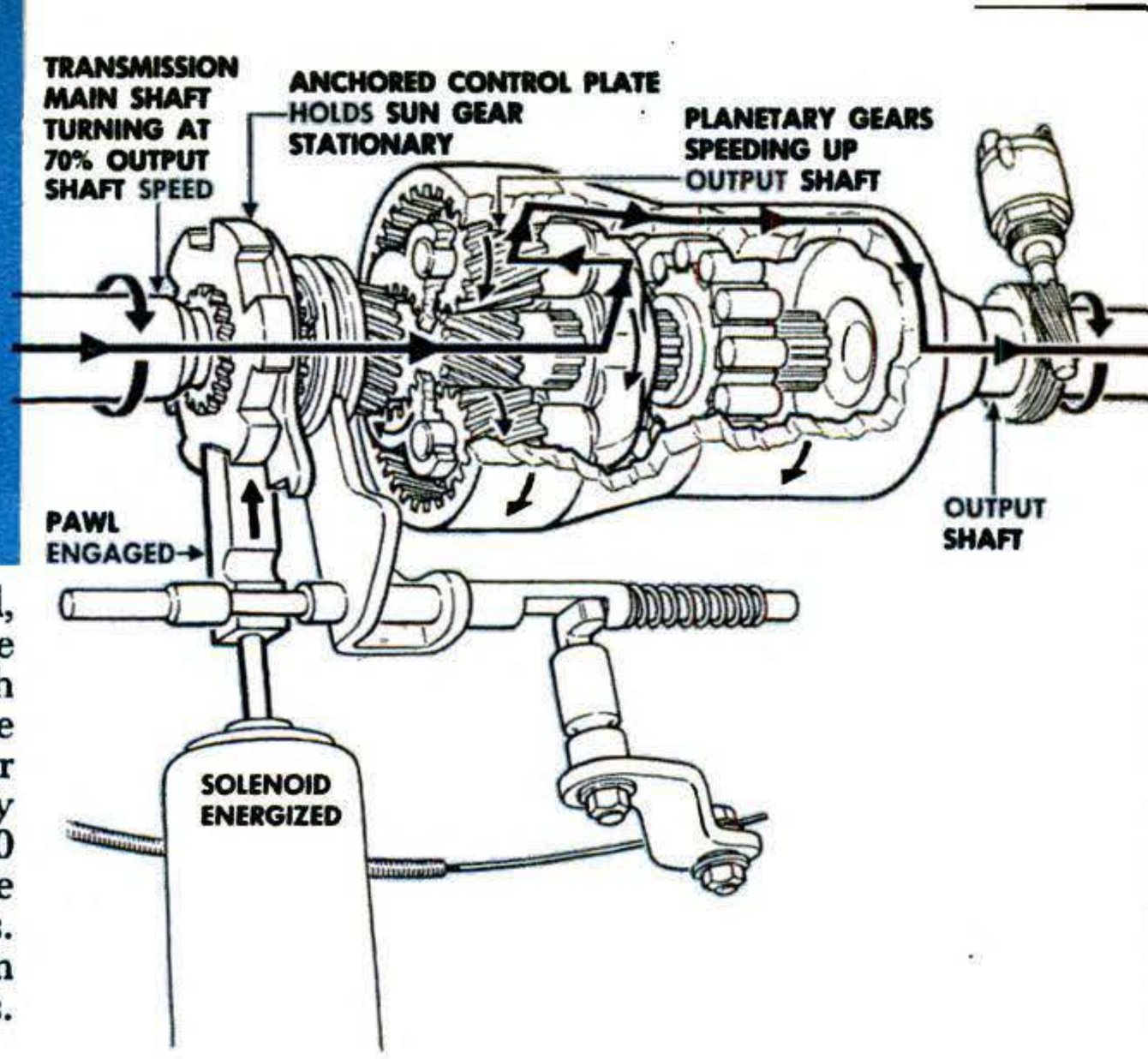
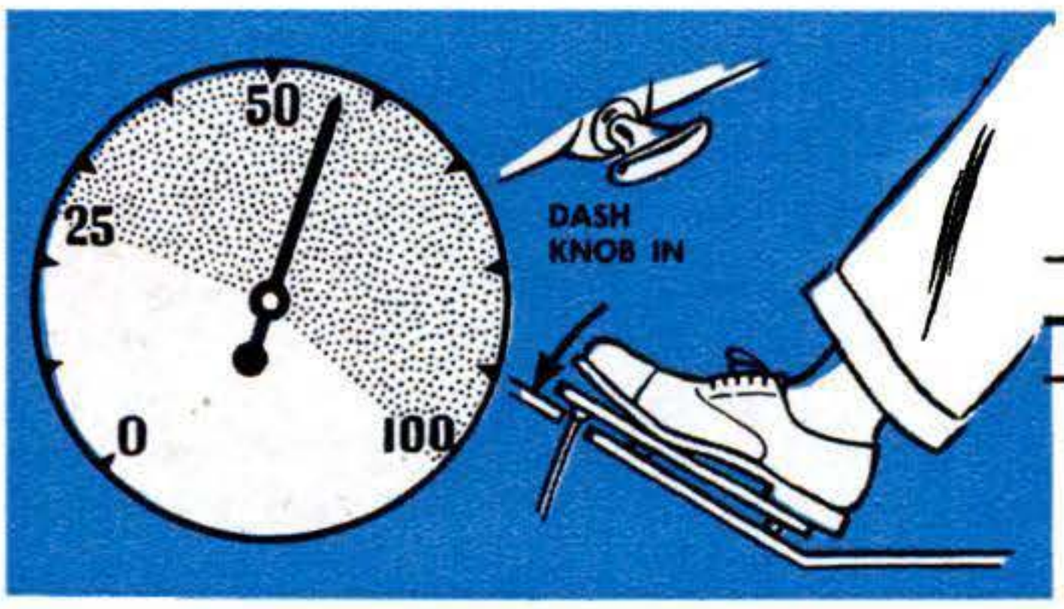
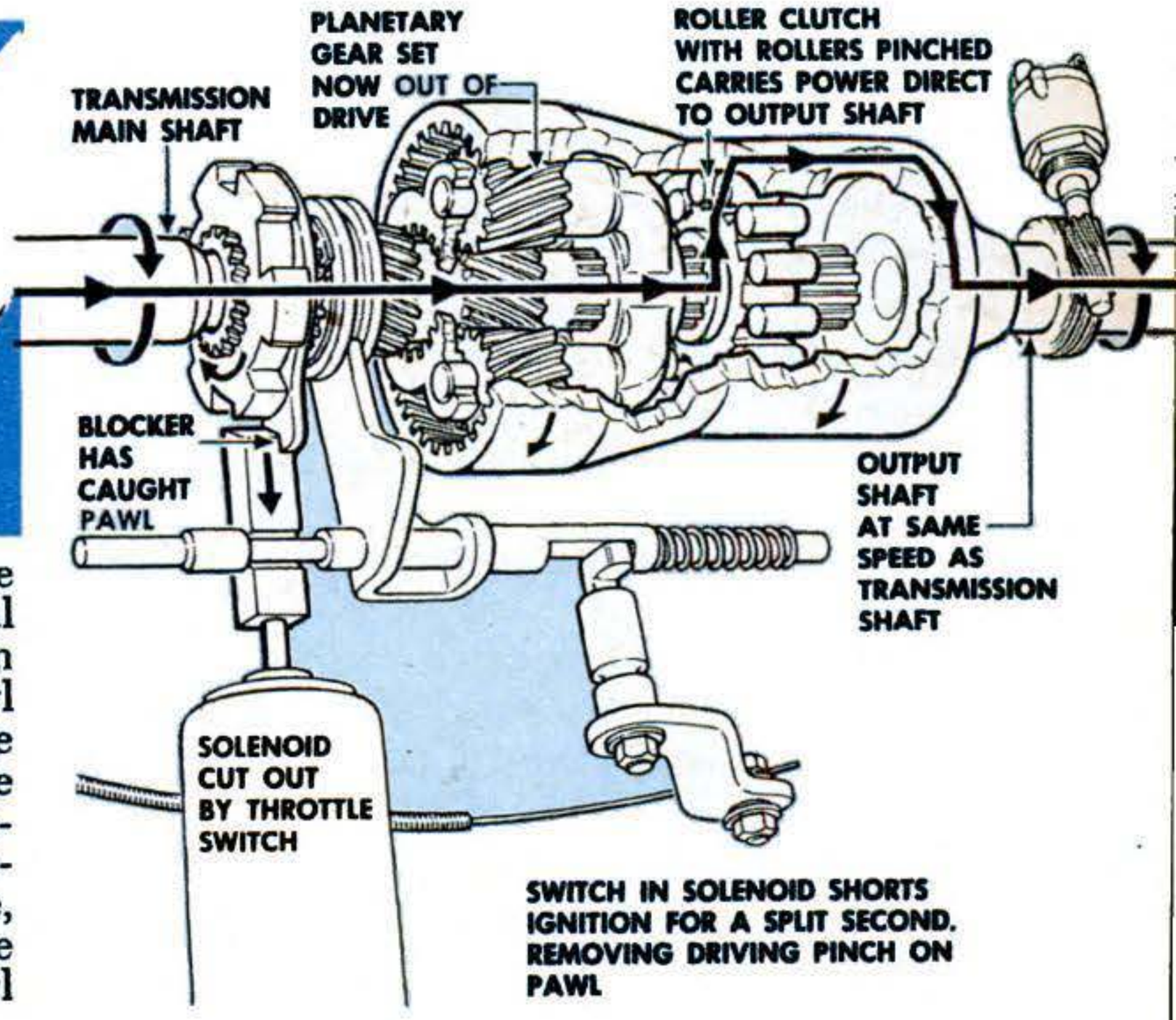




Now you're in overdrive. With pawl engaged, control plate keeps sun gear from rotating. Drive is now from main shaft to pinion cage through splines. This causes pinions to walk around the sun gear, transmitting the power to the outer ring gear, thence to the outer race, and finally to the output shaft. The engine travels only 70 percent as fast as car. This is because of the step-up in ratio provided by the planetary gears. For every revolution made by ring gear, pinion cage makes only .7 revolution on its own axis.





Pushing gas pedal to floor shifts overdrive down to conventional gear. When down, pedal works kickdown switch, cutting current from solenoid. A spring then tends to withdraw pawl from sun-gear plate. However, the engine torque pinches and holds pawl. To overcome this, the kickdown switch also interrupts ignition for fraction of second, slowing engine and causing reverse torque. This allows pawl to disengage, giving direct drive. When car slows below the cut-out speed, governor cuts solenoid, pawl withdraws, and freewheeling drive results.

with the clutch, however. Low is not a "synchronized" gear and you may cause clashing.

This clutchless shifting at low speeds is made possible by the freewheeling built into the overdrive unit. Each time you let up on the gas, the car freewheels. When you shift, the overrunning clutch within the unit automatically does the job of the regular clutch.

Overdrive cut-in speed is set at the factory. It varies with the make of car—somewhere between 18 and 32 m.p.h. After passing this speed, you lift your foot from the accelerator. The result is an automatic upshift into overdrive. If the regular transmission is in second, you go into overdrive second. If it's in high, you go into overdrive high.

When you need a quick burst of power, perhaps to pass another car, you simply jam the accelerator to the floor. This automatically downshifts to conventional gear.

At car speeds above the overdrive cut-in point, you must use the regular clutch to shift between conventiontional high and second gears. That's because the overrunning clutch doesn't have a chance to do the job it does below cut-in. As soon as you lift your foot from the gas pedal, the unit automatically upshifts into overdrive.

Unless you kick down to a conventional gear, the overdrive ratios continue to function until car speed drops to about 4 or 6 m.p.h. below the cut-in speed. At this point,

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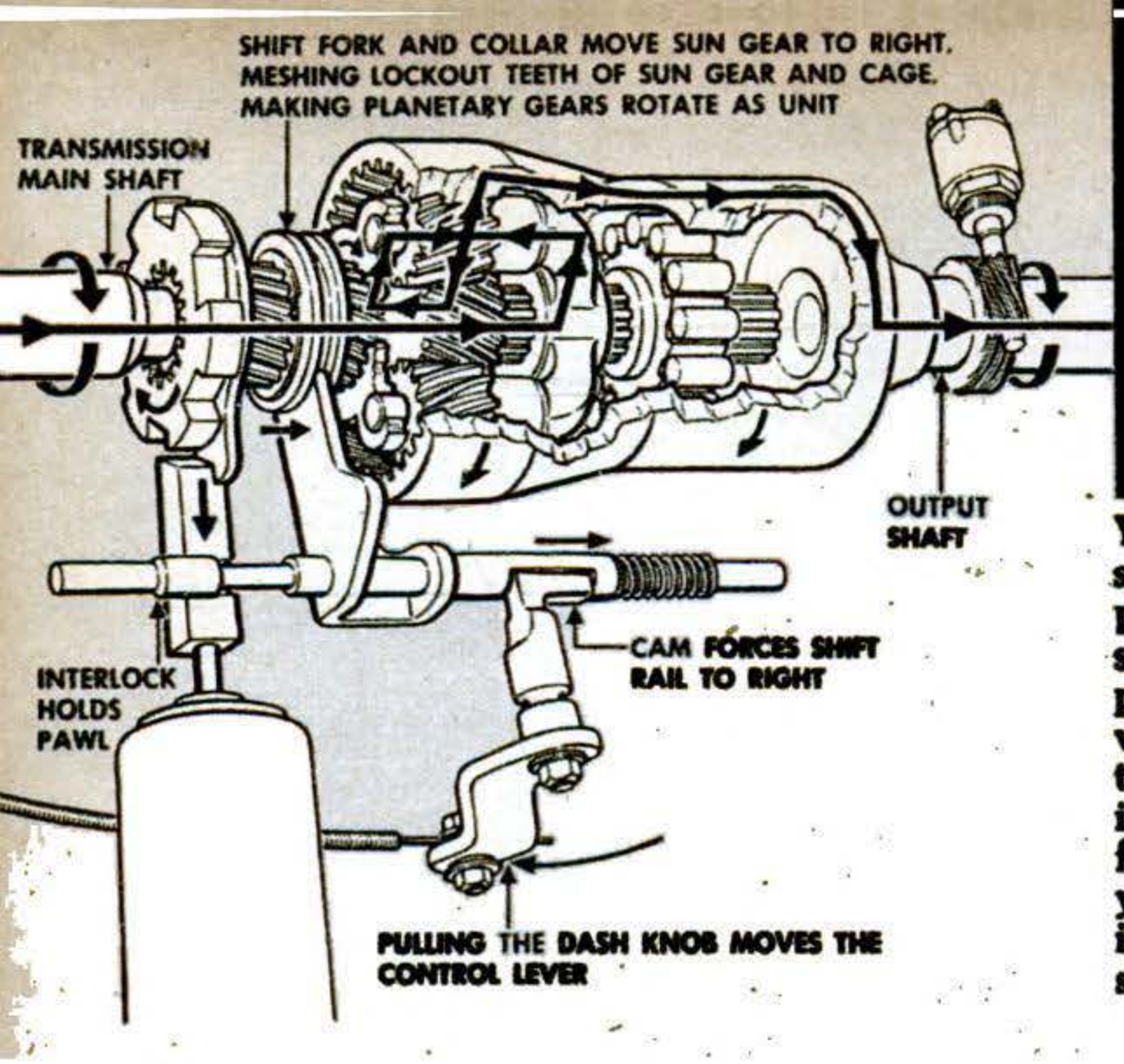

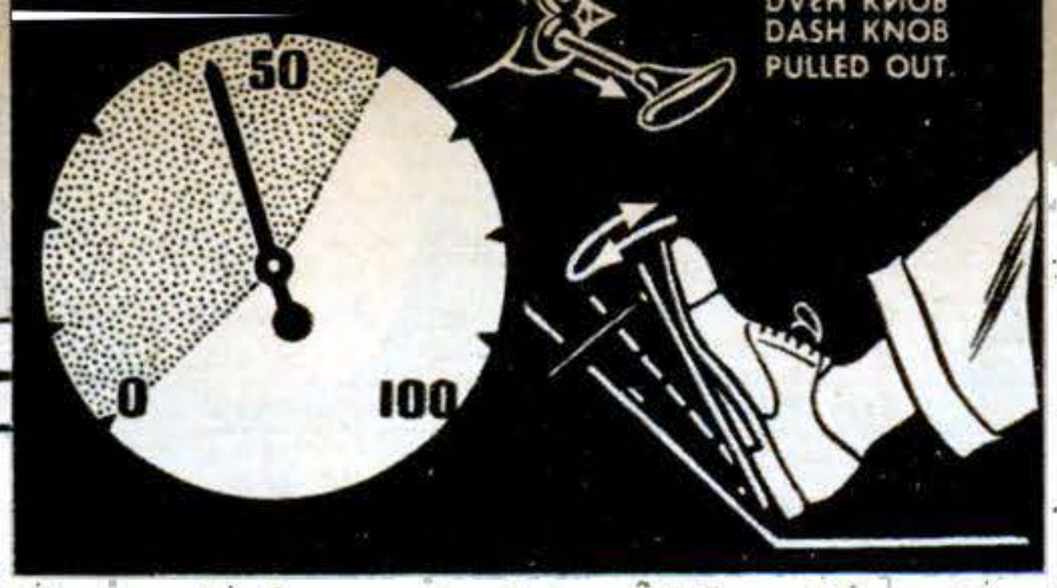

You can lock out overdrive while car is moving simply by kicking down accelerator and then pulling out dash knob. Pulling the knob moves shift rail and shift fork, bringing sun gear into position so that the teeth at right of shift collar will engage the corresponding internal teeth in the pinion cage. This makes entire group of internal working parts turn as a unit, eliminating freewheeling and overdrive. Before pulling knob, you must press gas pedal to kick down overdrive if engaged and cause meshing gears to turn at same speed.

the car automatically reverts to conventional gear, either second or high, when the governor cuts power from the solenoid.

You can lock out overdrive entirely at any speed. Just push down the accelerator momentarily and pull out the knob. It can be done so quickly that you get almost no acceleration—a point to remember if you are descending a hill and need to lock out to get engine braking.

Overdrive has passed through a series of engineering changes since its introduction in 1934. Early types were controlled by a speed-sensitive automatic clutch that required a driver to slow down to cut-out speed to reengage conventional drive. In 1939, an electric kickdown switch permitted shifting back to conventional drive above engagement speed.

In the latest overdrive, the governor and solenoid are the principal electric controls. The governor is operated by the car drive shaft. When the car reaches the cut-in speed, with the control knob in, the governor switch closes, sending current to the solenoid. Energized, the solenoid tends to push the engagement pawl toward the notched control ring attached to the sun gear. However, the blocker ring stops and holds the pawl.

This horseshoe-shaped ring rides on the hub of the control plate. Friction causes it to respond to movement of the control plate, through a small arc in either direction, until arrested by stops.

The sun gear and control plate are a single, splined unit that surrounds the transmission main shaft. This point is essential to understanding how overdrive works. Until an overdrive ratio is engaged, the sun gear merely idles. While the ratio is engaged, the sun gear is held stationary.

When you let up on the accelerator momentarily, the engine slows but the momentum of the car tends to drive it. The power flow is reversed. Torque reversal occurs.

In a fraction of a second, the sun gear and its control plate slow, stop, and then twist backward slightly. Friction carries the blocker ring along. Allowed to slip off the step of the ring, the pawl thrusts inward, engaging the notched collar and locking the sun gear.

When you kick down from overdrive to conventional gear, the notched control plate must be released by withdrawing the pawl. Engine torque, however, binds and holds the pawl. When you push the pedal to the floor, a switch opens the solenoid circuit. It also closes contacts that temporarily interrupt the ignition.

Interruption of the engine torque allows the pawl to be snapped out by a strong spring, whereupon the ignition and engine torque are restored. The entire sequence happens so fast that only a few explosions are missed.

Upon release of the pawl, the engine speeds up. When its speed reaches the value corresponding to direct drive, the roller clutch engages and you operate in conventional gear. This continues until the driver no longer needs full power and lets up on the pedal. As he does, overdrive again engages.

What about reverse? That's taken care of, too. Since the roller clutch will not drive the car backward, the transmission reverse-shift mechanism automatically locks out overdrive. There's no need to touch the control button. END

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New Torque Converter Drives Bus

EVER feel the surge of power as a modern bus pulls away from the curb? There's no jerking, no gear changing. A hydraulic torque converter does the trick.

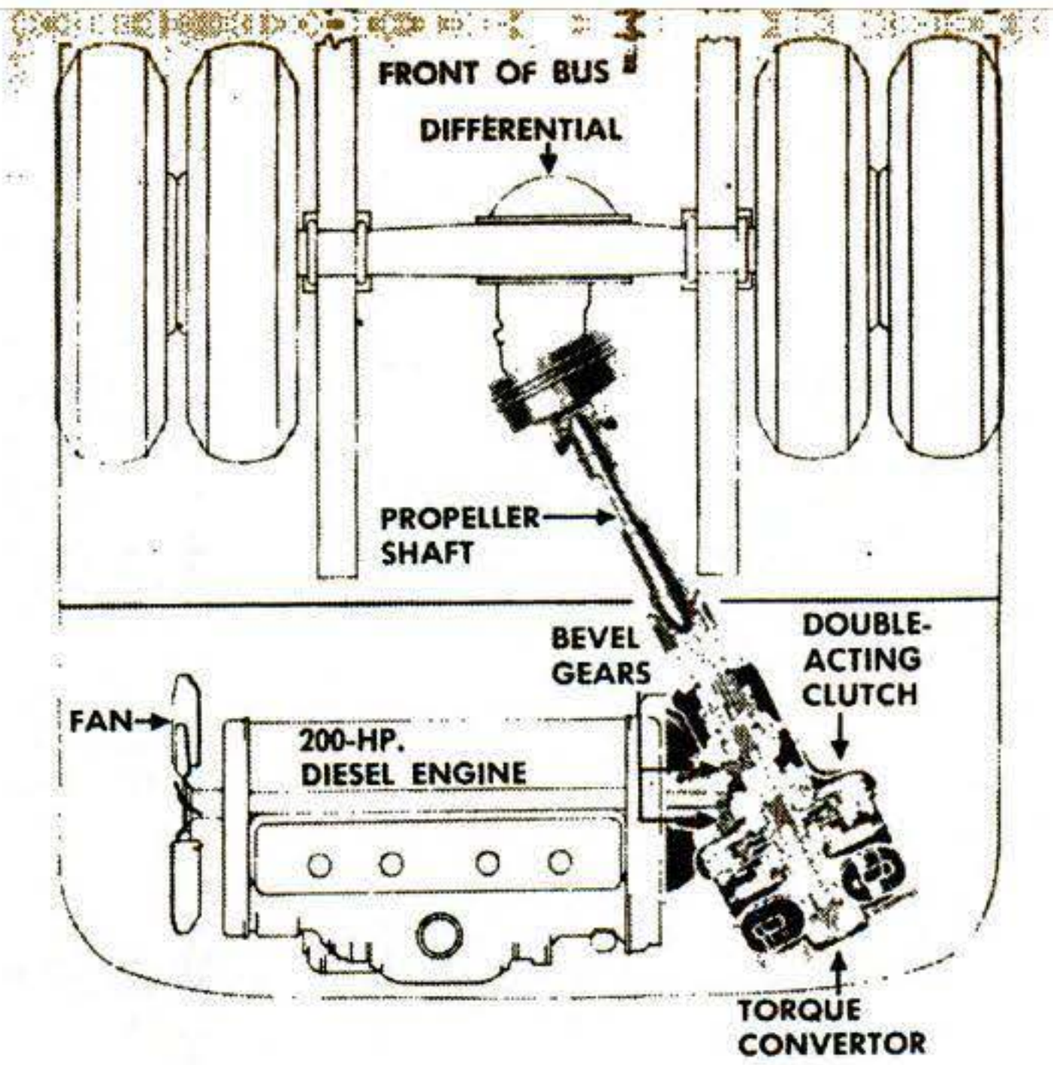
Some buses have been fitted with this type of no-shift transmission for as long as ten years. Buick introduced it to passenger cars last year (PS, Feb. '48, p. 113). Now General Motors is announcing an improved type for bus use.

Passengers will notice little difference between the new and old—but repairmen will. It's less bulky, 300 lb. lighter, and readily accessible for servicing.

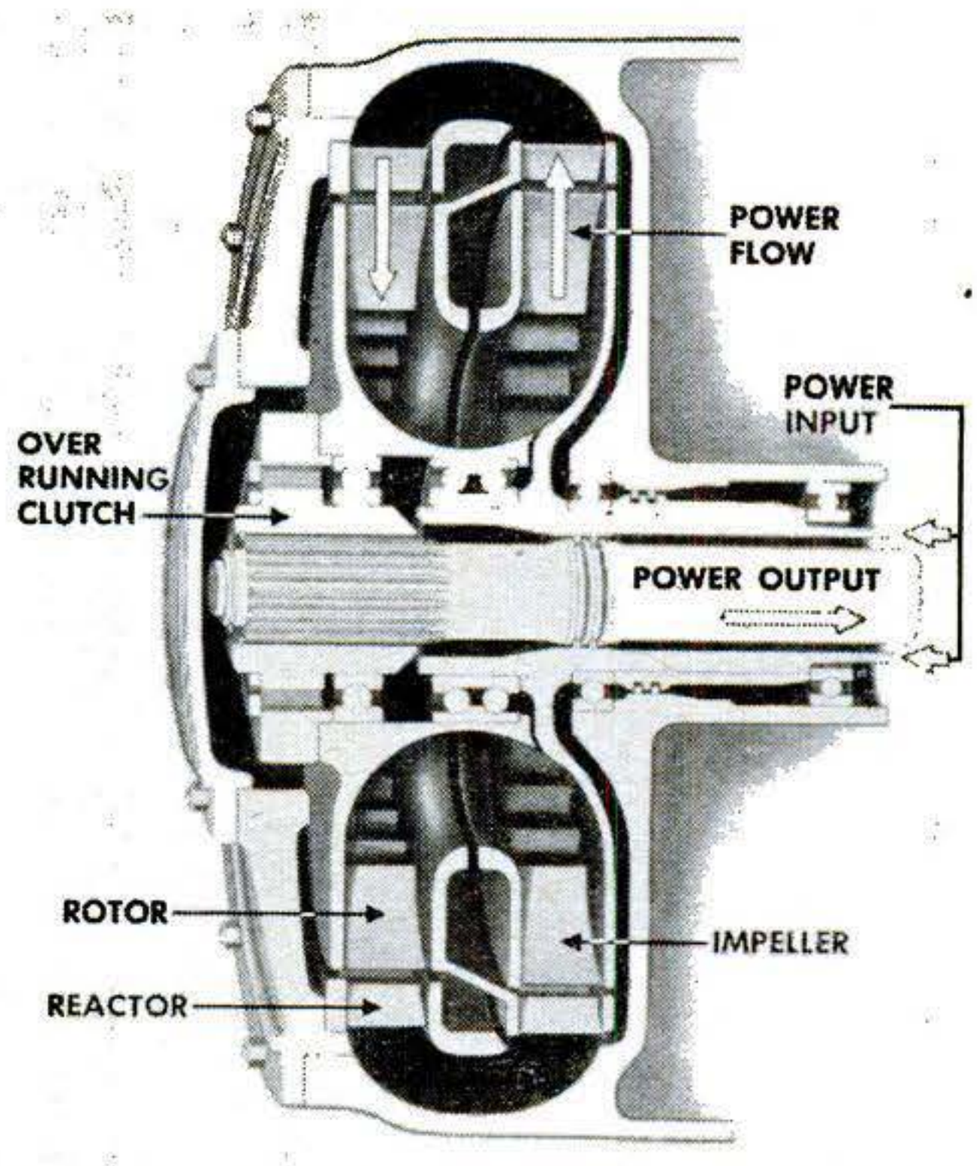
Attached to the rear end of the transmission assembly, a torque converter of new design delivers power from the same side that it receives it. In older type, power flows straight through the unit.

The transmission assembly includes two major parts—the converter and a double-acting clutch. The engine drives the clutch. At low speeds, the clutch shunts engine power to the converter, and the latter increases the torque delivered to the drive shaft—just as low and second gears do in an ordinary transmission. When the bus reaches a certain speed, the double-acting clutch automatically gives direct drive. At this stage, the rear end of the drive shaft merely idles in the overruning clutch within the converter.

Pressurized oil fills the converter casing at all times. The impeller and rotor revolve; the reactor is stationary.

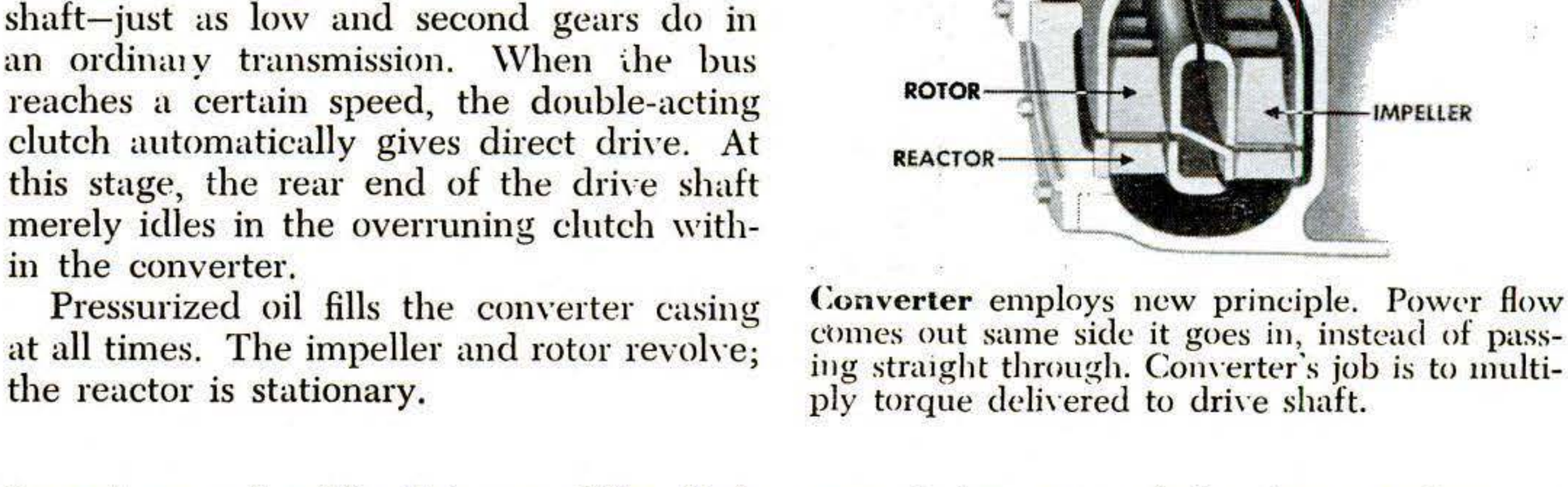


Hydraulic transmission just introduced by GM sits at angle to engine, located across rear of bus. Bevel gears carry engine power to the transmission. Converter is easily removable.



Converter employs new principle. Power flow comes out same side it goes in, instead of passing straight through. Converter's job is to multiply torque delivered to drive shaft.

Large buses ordered for Chicago and New York City are first to use new transmission. Longest one-unit buses ever built, these coaches seat 50 to 55 passengers and stand many more.



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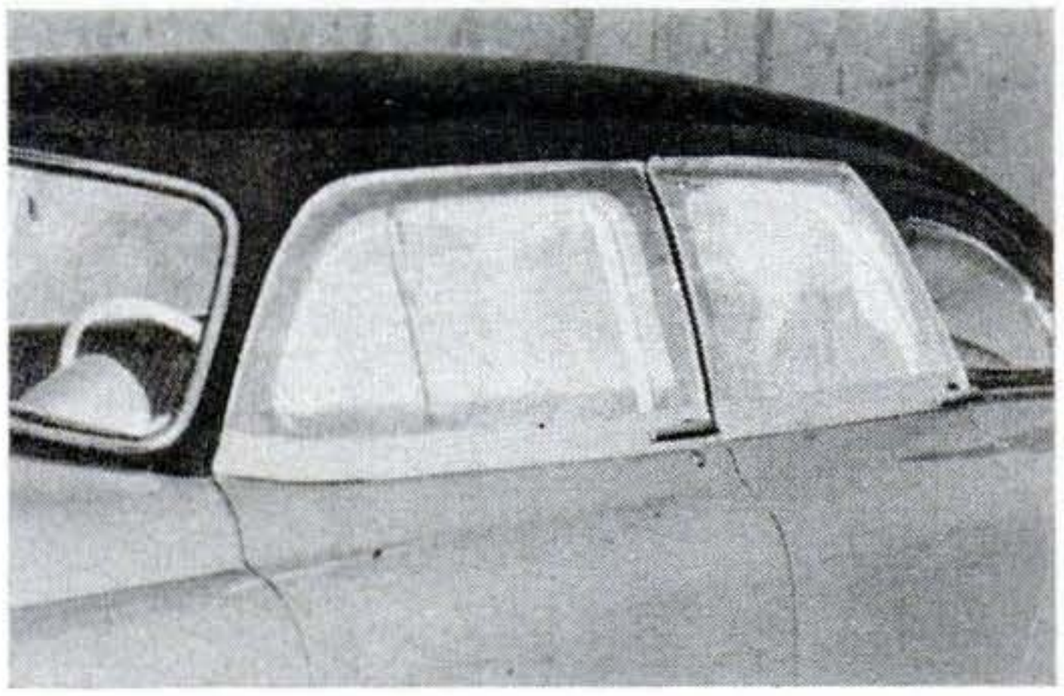
Engine Converts Trailer to Home on Wheels

MOBILE and compact, the rolling home pictured above is a standard trailer powered by a Mercury V-8 engine. The trailer body was reversed, front to back, and mounted on a specially built chassis. Windshield, instrument panel, and controls were installed bus fashion while the engine, with twin radiators and fans, was mounted in the rear. The vehicle weighs 7,200 lb., goes 10 miles per gallon, is 25′ long, and has a 13′ wheelbase. It sleeps two and has all conveniences.—*John F. Wilson, Toronto, Ont.*

Special Mitt Washes Autos

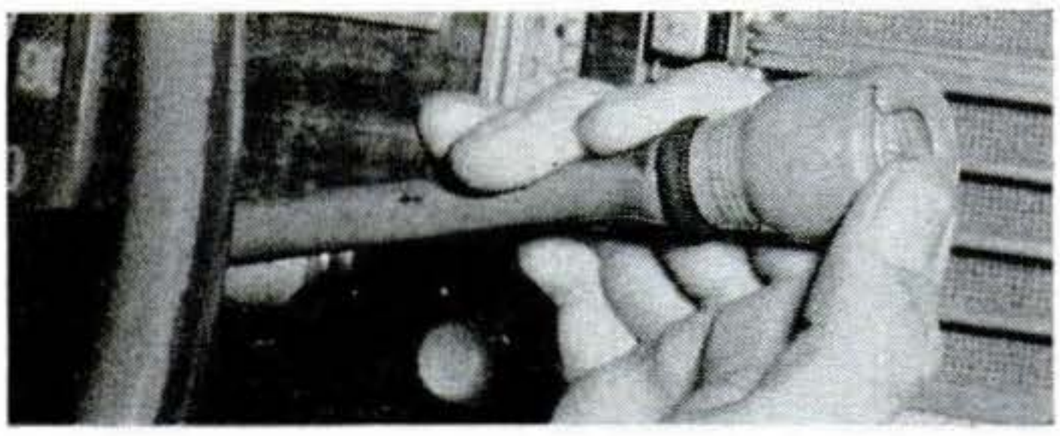
STICK a couple of the pellets in the Magic Bubble Mitt®, put on the mitt, dip it in water, and you're ready to wash your car. When finished, rinse the car with a hose. This, according to the Pit-Bar Manufacturing Co., Los Angeles, leaves the car shining without wiping. The mitt, made of lamb's wool, and 12 pellets are priced at $1.20.



New Nash Has Plastic Screens

MADE of Lumite®, the plastic screens on the 1949 Nash are installed by slipping them over the tops of the doors. An elastic insert in the bottom edge insures a snug fit. Seats in the Nash can be converted to twin beds for overnight stops. The screens were developed to protect sleepers from insects. The plastic is rustproof, stainproof, and flexible.

Gearshift Coin Clip Holds $2 in Change



HELD to the gearshift lever by a rubber adapter, this plastic coin clip takes any coin from a cent to a quarter. It holds about $2 in change right at your finger tips for parking meters, toll bridges, and other petty expenses. Distributed by Rosenberg Brothers, New York City, it's priced at about 50 cents.

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Mechanics and Handicraft

REG. U. S. PAT OFF

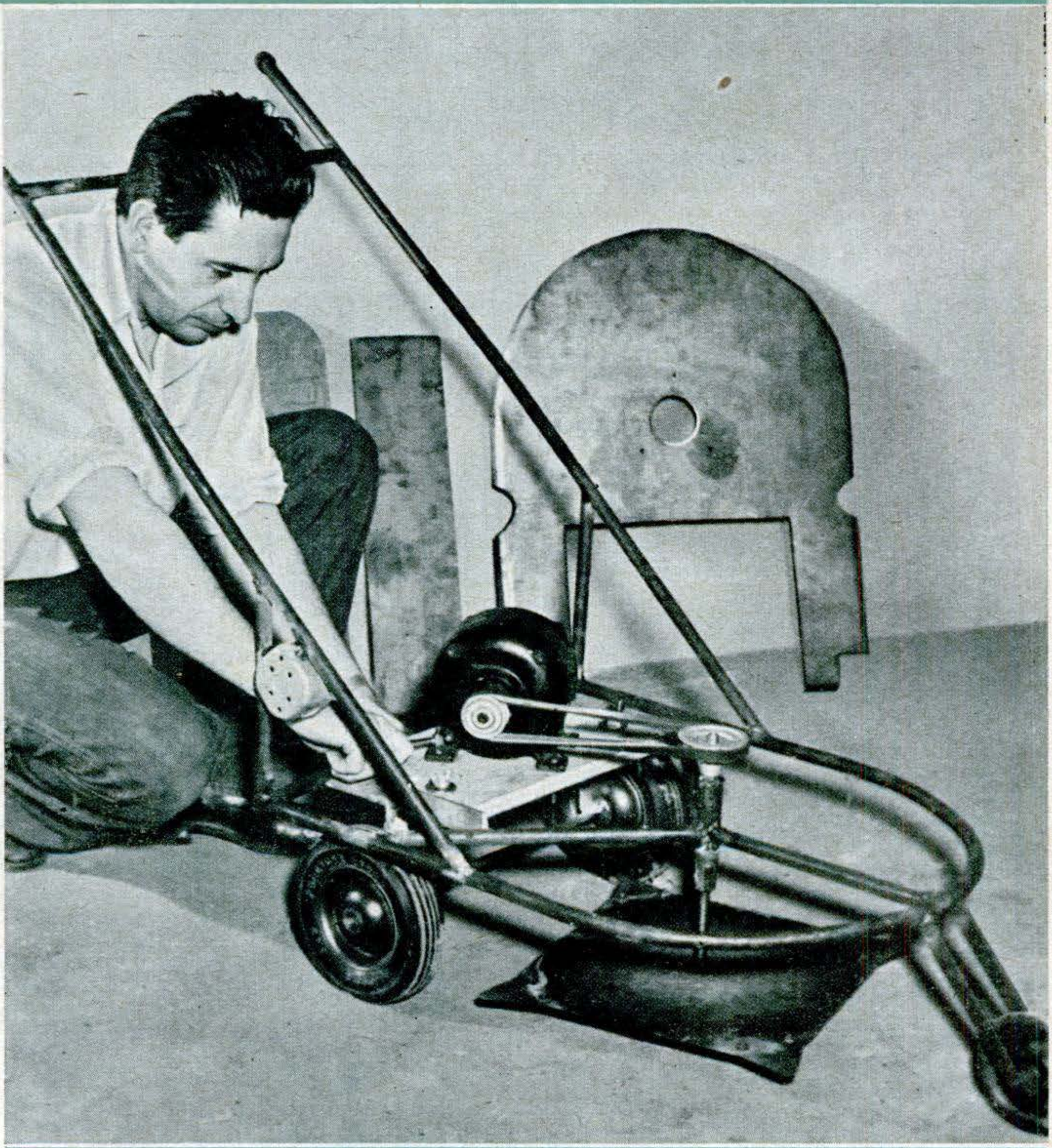
Rotary Mower Cuts Lawns PAGE 242

Modeling a Narrow-Gauge Loco PAGE 188

How to Fix Zippers PAGE 209

Television Set from a Kit PAGE 226

Edge-Molding with Power Tools PAGE 234



Let electricity provide the muscle for barbering your lawn this summer. Page 242

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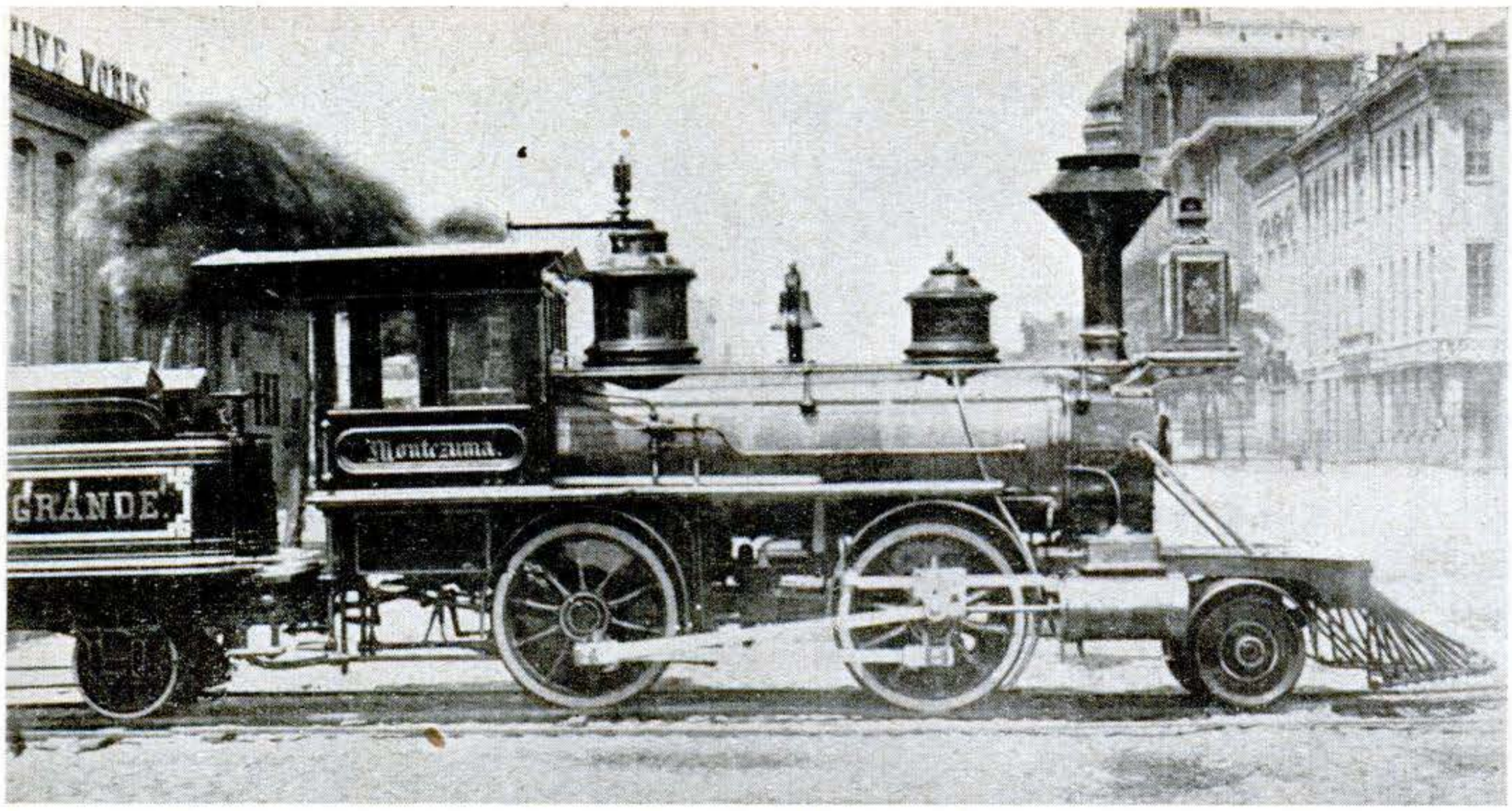


Built by the Baldwin Locomotive Works in 1871, the Montezuma had steam jets on the front of the cylinders to scare cattle. Because of its 3′ gauge, it was shipped to Denver on flat car.

Old Narrow-Gauge Engine Modeled in HO Scale

By George Walton

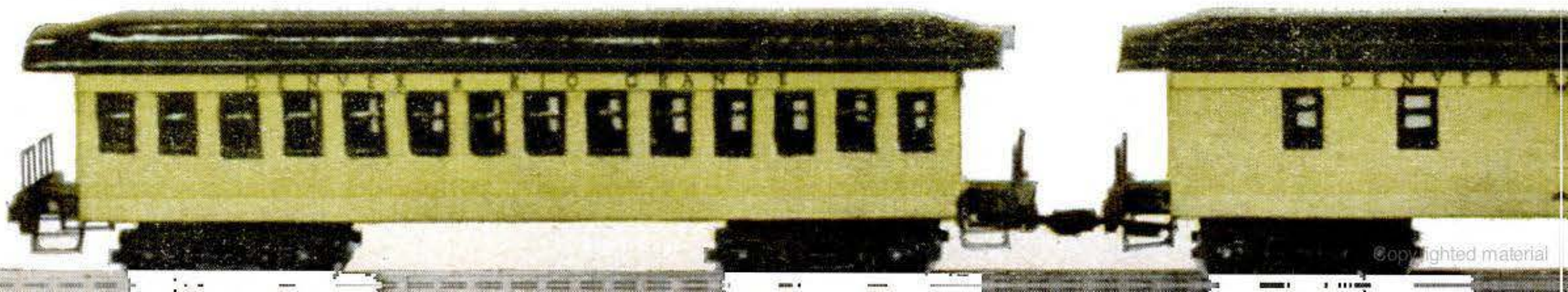
A HANDSOME old-timer to model for your HO layout is the Baldwin-built Montezuma, No. 1 locomotive of the then narrow-gauge Denver and Rio Grande Railroad.

The Montezuma ran on a 3′ track, and the model pictured here was scaled 7/32″ to 1′. This is larger than HO scale, but enables the engine to run on regular HO track. With old-style coaches coupled behind, the colorful 2-4-0 is a thrilling picture on any pike. Scale speed is well over 100 m.p.h.

Only the motor, gears, and wheels were purchased. These came to about $9. The motor, a 12-volt DC job, is coupled through a worm-gear drive of 29-to-1 reduction. The frame was cut away in the rear to receive the motor. Two upright clips soldered to the frame in front of the motor were bent over to anchor its front end. The rear end is bolted to a plate soldered into the frame. You'll have to adapt the mounting method to suit your motor.

Cut and file the frame from ½″ by ½″ brass channel. Notch the frame for the axles. To get the inner end of the notches rounded,

Oldtime, open-platform coaches for the Montezuma are painted a colorful yellow and green.



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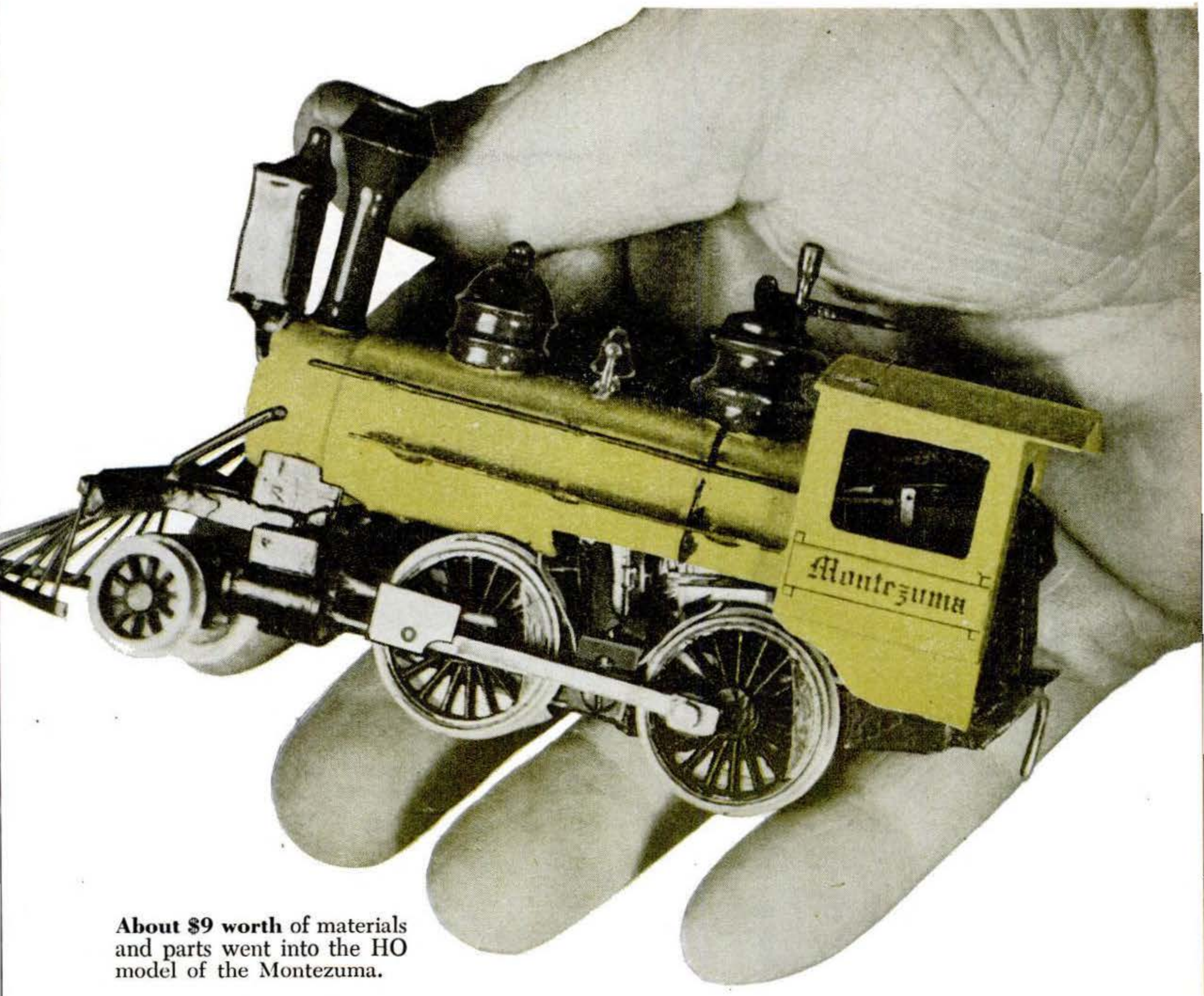

About $9 worth of materials and parts went into the HO model of the Montezuma.

drill a hole there and then saw to it. At this time also make any adjustments in the motor position so the worm gear meshes properly with the gear between the front pair of drivers. To reduce side play of the drivers, slit small washers and solder them to the frame around the axle slots.

Form the apron of .020″ brass and punch it around the edge to simulate rivets. Solder it to the front of the frame. Next cut the boiler saddle of .032″ brass, bend it as indicated, and solder it in place. This forms a cradle for the boiler front. The assembled cylinders also are soldered to the cradle.

A row of ordinary straight pins and two brass strips, one bent, form the cowcatcher. Lock the pins in a vise to solder them to the top strip. Then bend them to their correct angles, cut them off, and solder to the other strip. Solder the top strip to the apron.

Short lengths of ¼″ copper tubing form the cylinders. Solder small washers to each end. Fill the hole in the forward washer with solder. Use a piece of brass, lead, or type metal for the valve chests. File them to shape and solder on top of the cylinders. Add the top plate, drilled for the steam pipe. Then solder the entire cylinder assembly to

This model oldtimer is a colorful addition to any pike.

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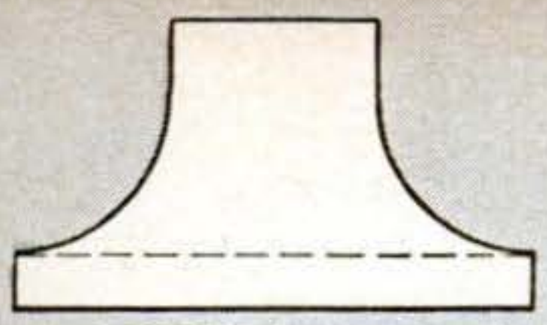
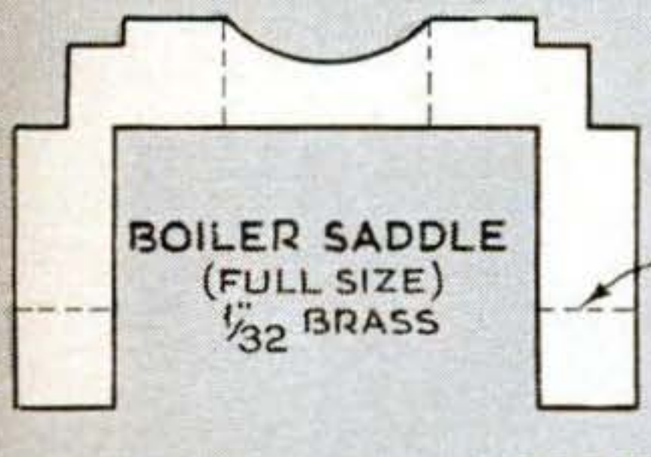
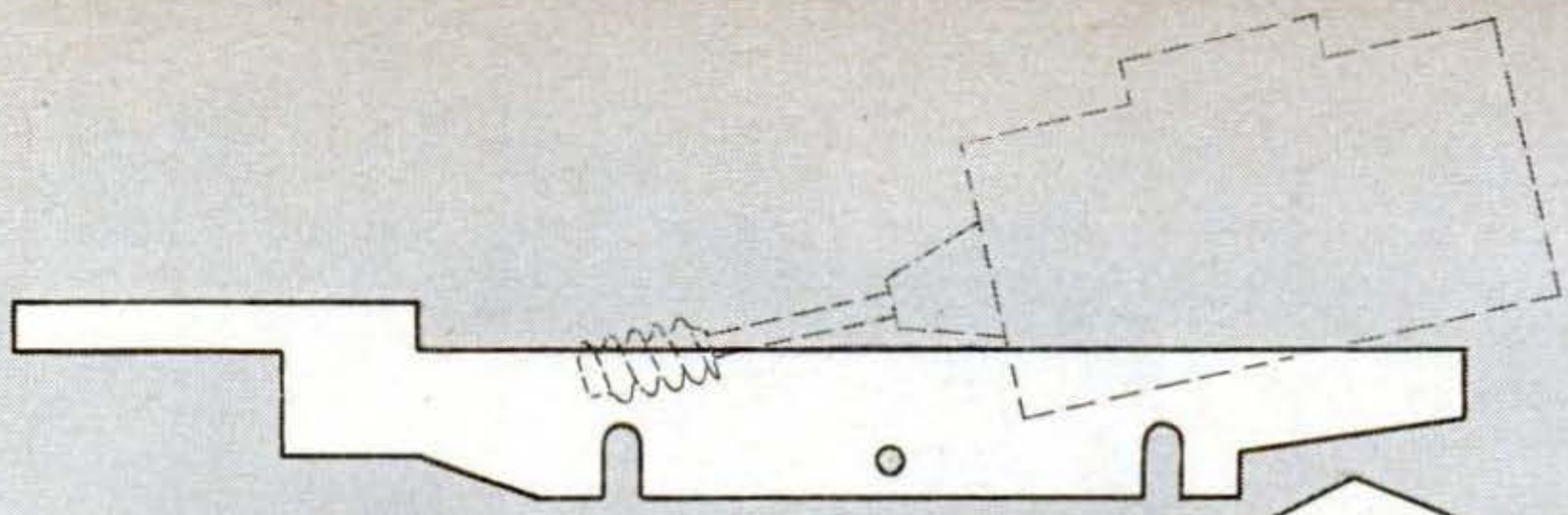


APRON (FULL SIZE)
.020" BRASS

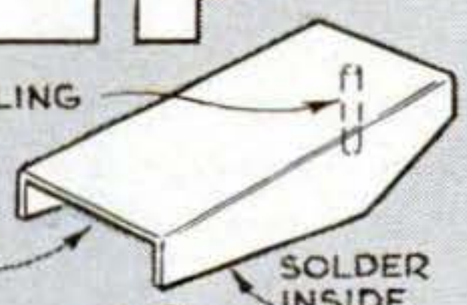


BOILER SADDLE
(FULL SIZE)
1/32" BRASS

BEND ON DOTTED LINES



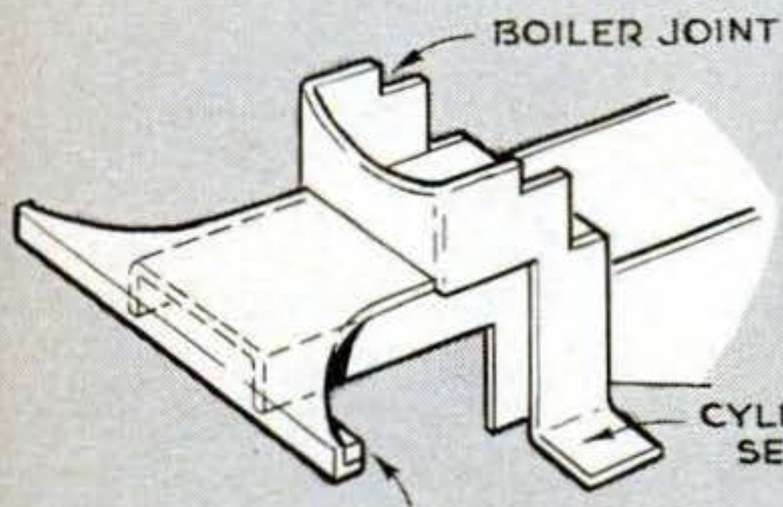
FRAME (FULL SIZE)
1/2" SQ. BRASS



COUPLING PIN

SHAPE TO SUIT MOTOR

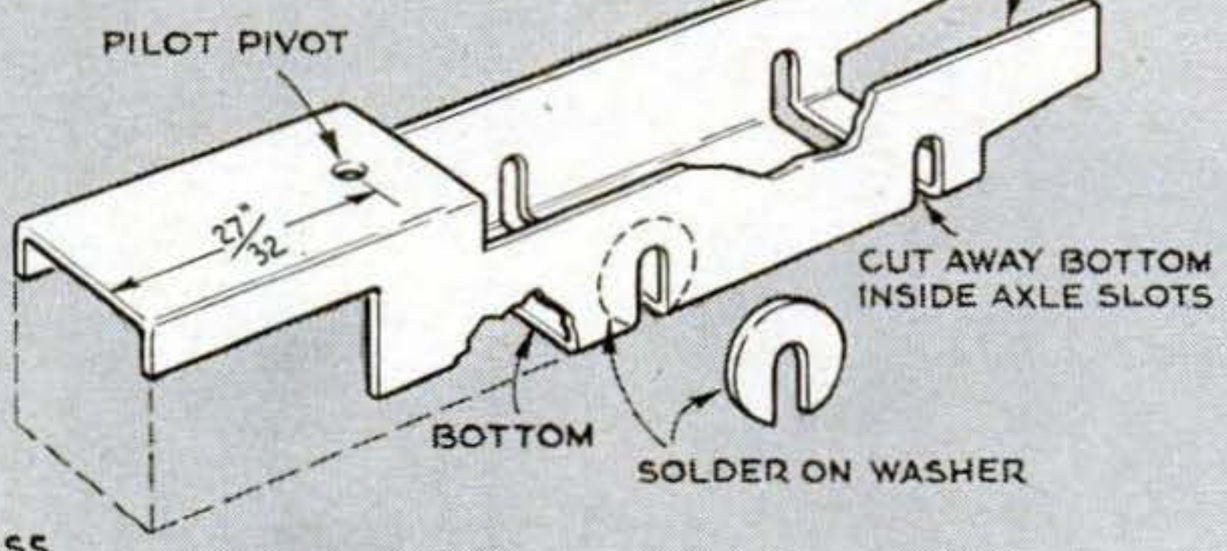
SOLDER INSIDE FRAME



BOILER JOINT FITS HERE

CYLINDER SEAT

BEND AROUND 1/16" BUS BAR



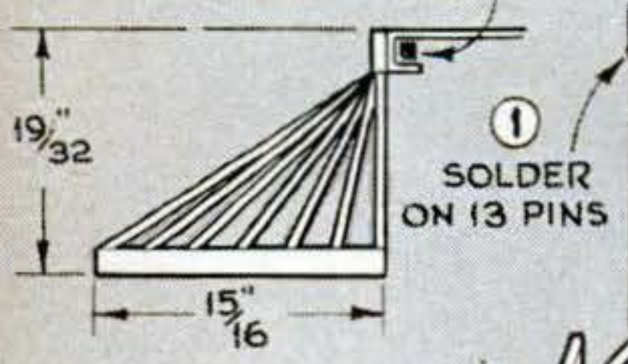
PILOT PIVOT

27/32"

CUT AWAY BOTTOM INSIDE AXLE SLOTS

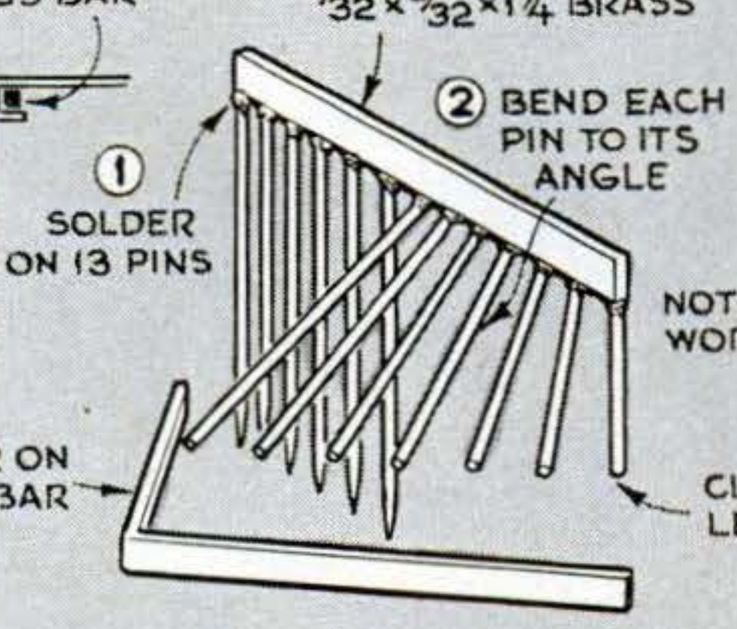
BOTTOM

SOLDER ON WASHER



19/32"

15/16"



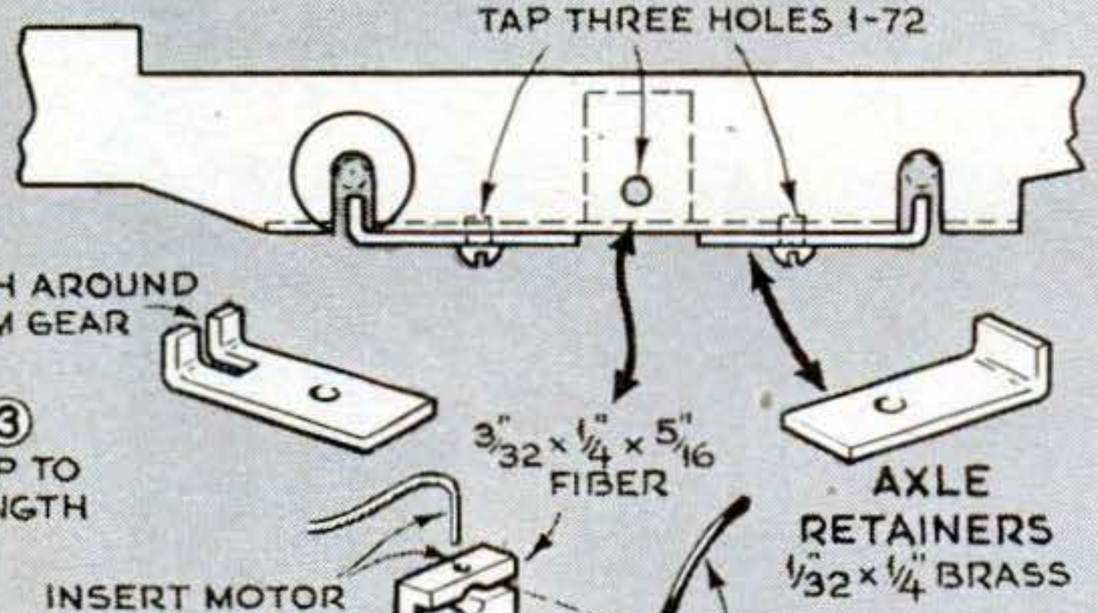
1/32" x 3/32" x 1 1/4" BRASS

① SOLDER ON 13 PINS

② BEND EACH PIN TO ITS ANGLE

③ CLIP TO LENGTH

④ SOLDER ON LOWER BAR



TAP THREE HOLES 1-72

NOTCH AROUND WORM GEAR

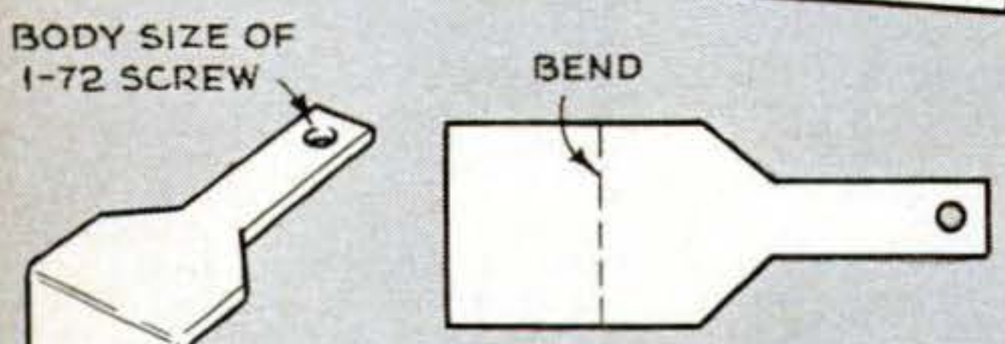
3/32" x 1/4" x 5/16" FIBER

AXLE RETAINERS
1/32" x 1/4" BRASS

INSERT MOTOR LEAD IN HOLE AND SOLDER TO SPRING

FINE SAW CUT

BEND SPRING WIRE TO CONTACT WHEELS



BODY SIZE OF 1-72 SCREW

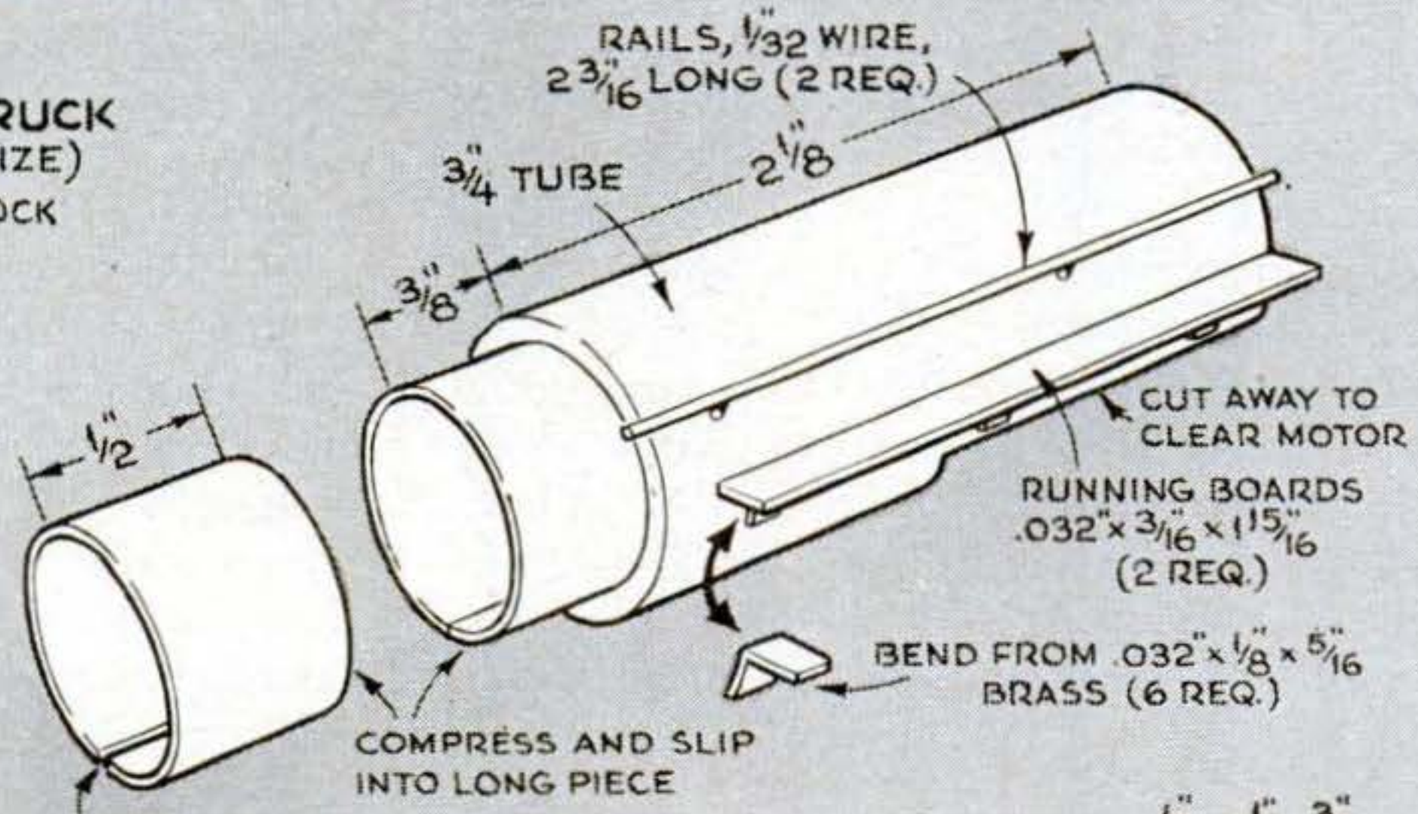
BEND

PILOT TRUCK
(FULL SIZE)
1/32" STOCK

1/4" x 3/8" x 1/2"

3/32" x 1/4" SLOT

CEMENT OR SOLDER WITH AXLE IN SLOT



RAILS, 1/32" WIRE, 2 3/16" LONG (2 REQ.)

3/4" TUBE

2 1/8"

3/8"

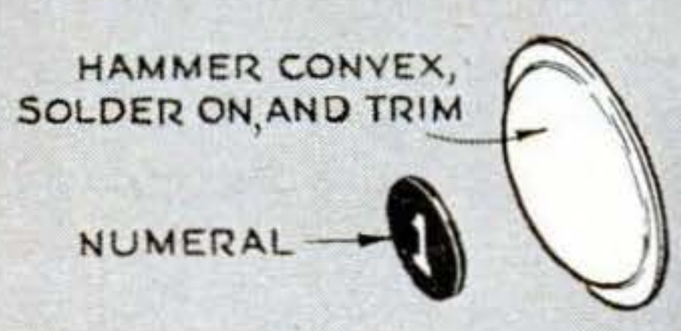
CUT AWAY TO CLEAR MOTOR

RUNNING BOARDS
.032" x 3/16" x 1 15/16"
(2 REQ.)

1/2"

BEND FROM .032" x 1/8" x 5/16" BRASS (6 REQ.)

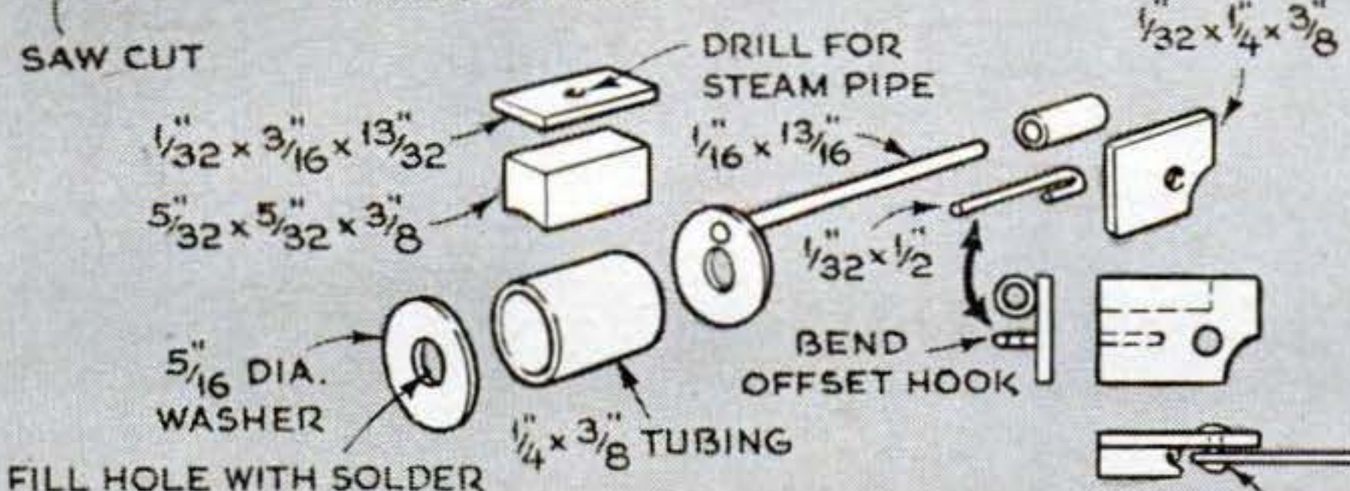
COMPRESS AND SLIP INTO LONG PIECE



HAMMER CONVEX, SOLDER ON, AND TRIM

NUMERAL 1

SAW CUT



DRILL FOR STEAM PIPE

1/32" x 3/16" x 13/32"

5/32" x 5/32" x 3/8"

1/16" x 13/16"

1/32" x 1/4" x 3/8"

1/32" x 1/2"

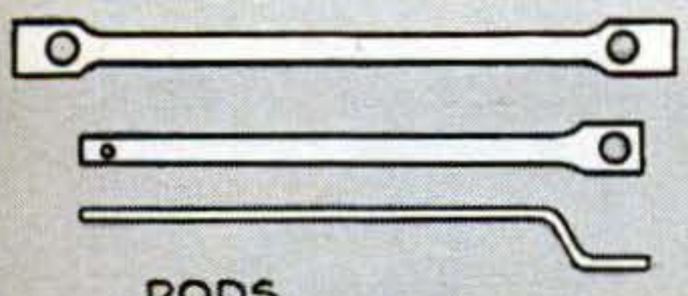
BEND OFFSET HOOK

5/16" DIA. WASHER

FILL HOLE WITH SOLDER

1/4" x 3/8" TUBING

SOLDER ROD TO PIN ONLY



RODS
(1/32" STEEL)

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the two horizontal lugs on the boiler saddle.

Drill and tap the frame for the screw to hold the piece of fiber that fits between the drivers. Slot the fiber to take a short piece of thin brass wire that will be bent to exert gentle pressure on both drivers. This is the current pickup for the insulated drivers. The axle retainers are two small pieces of brass bent and screwed to the bottom of the frame. Notch the forward one to fit around the worm gear.

For the pilot, buy a pair of 7/16" insulated or plastic wheels mounted on an HO axle. Lay out the metal part of the truck and bend it as indicated. Notch the ¼" by ⅜" by ½" plastic block and cement it in the bend of the metal. After putting in the axle, cement a thin piece of plastic over the bottom of the slot. The rear of the truck is attached to the frame by a pivot screw. If you prefer, the notched block can be of metal, and the whole job soldered up.

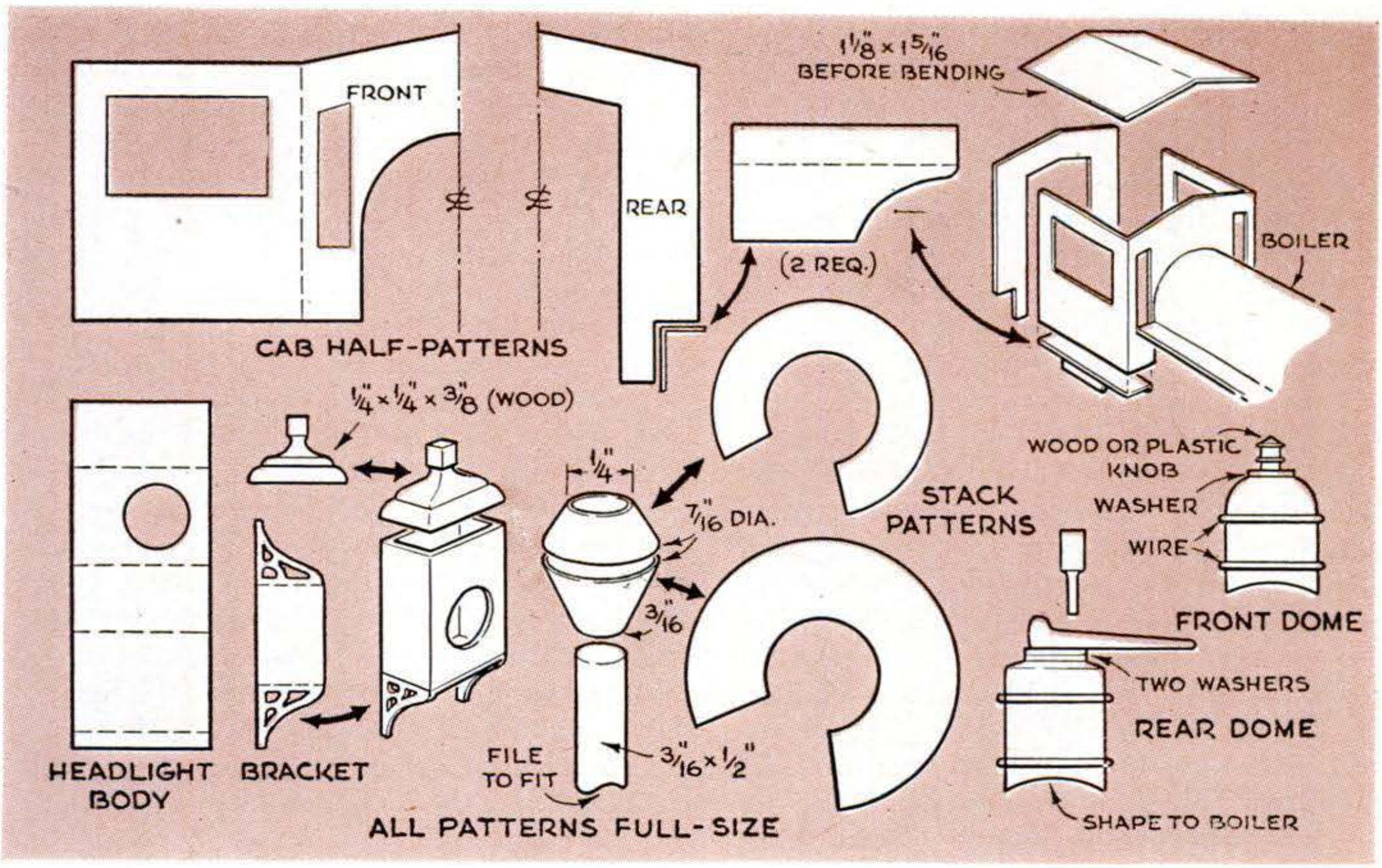
Two pieces of ¾" brass tubing make up the boiler. Slit the ½" length, compress it, and telescope it into the longer length. Hold it with solder. A circle of .020" or thinner brass forms the boiler front. Cut it a little larger than the boiler diameter and hammer it to a rounded shape. Solder it to the boiler front with the rounded side out. Carefully trim and file it to the outline of the boiler. You can make the numeral 1 for the front of the boiler by typing it on a piece of .010" brass. Cut out a small circle containing the number and cement it to the boiler. Before assembling, a punch may be used gently to simulate rivets around the number and around the boiler front.

Depending on the motor you use, it may be necessary to cut away the underpart of the boiler at the rear to clear the motor. You'll probably also have to cut a hole toward the front to clear the worm gear.

All cab patterns are shown full size. Cut them from .032" sheet brass and file the edges smooth. Start the windows by drilling and finish by filing. All parts are soldered together, the roof going on last. Solder the assembled cab to the rear of the boiler.

Stack, headlight, and headlight bracket are cut from .010" brass. Roll up the pieces that form the stack to the given diameters. Then snip the excess off one end and solder. Easiest way to make the headlight top is to carve it of wood or plastic. If you wish, fit a midget bulb in the lamp before final assembly. Use a bulb of the same voltage as the motor. A small burr in a hand grinder will help cut out the scrollwork on the lamp bracket. You can, instead, simulate it when you paint the model.

Make up the domes from dowels or copper tubing to which caps of brass sheet have been soldered. The rings encircling the domes can be bus bar or wire that's soldered or glued in place. For a whistle, I used the



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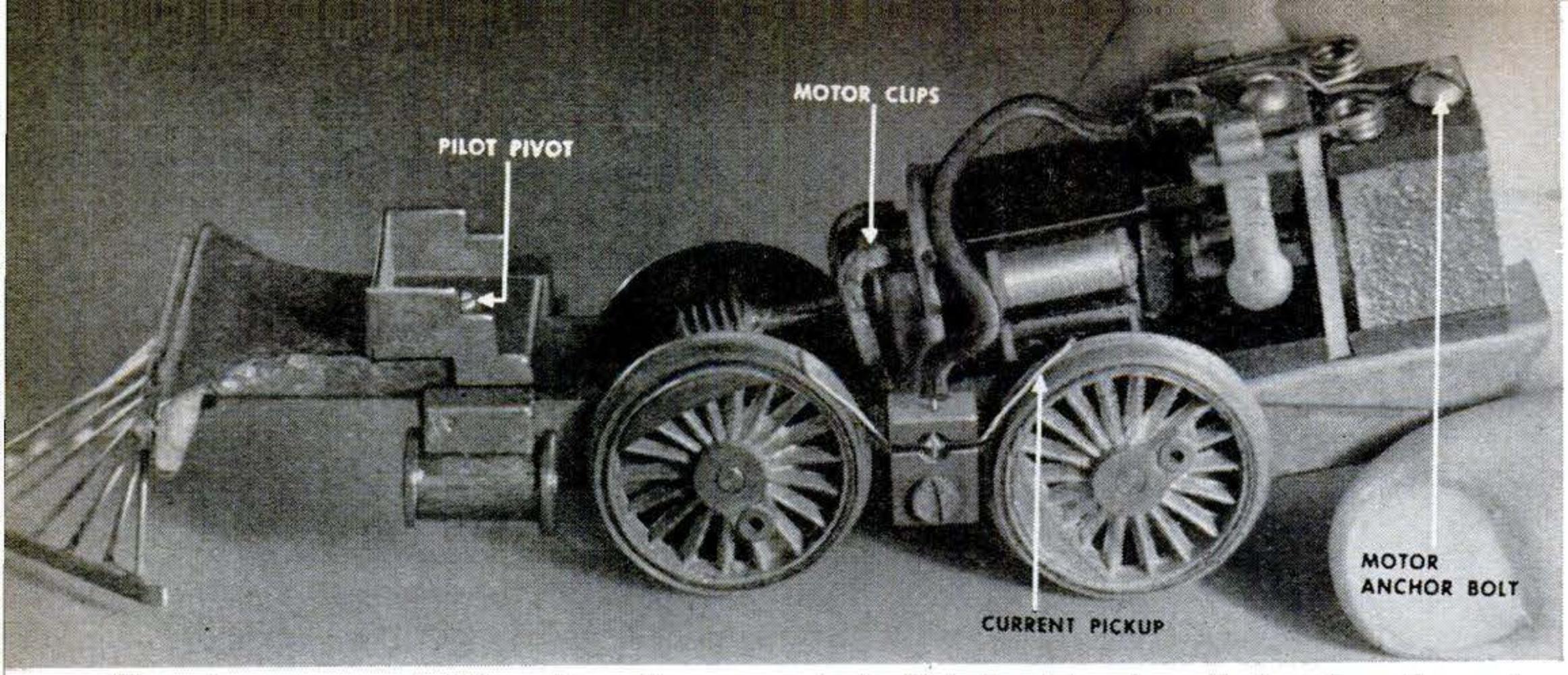
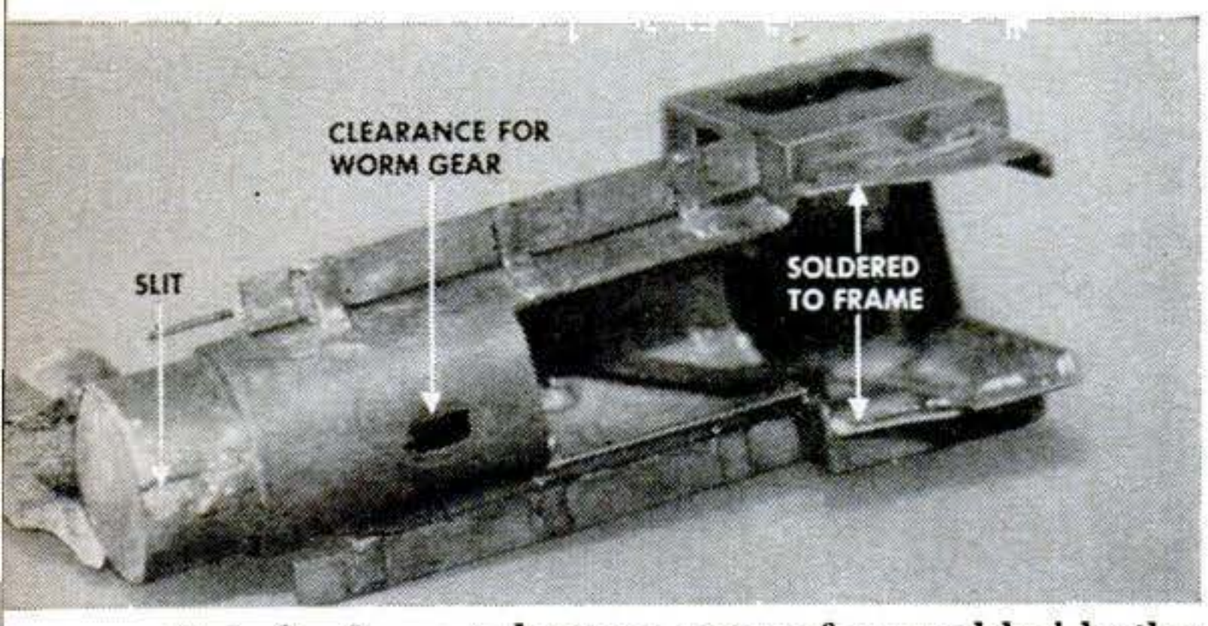
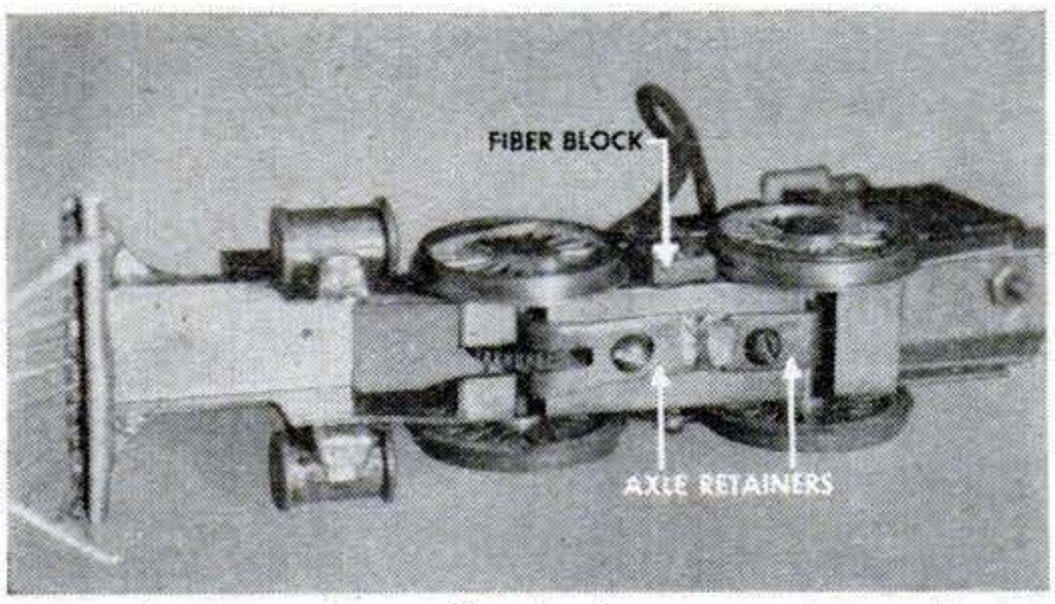


Here the motor and drivers have been mounted. Note bent bus bars that anchor the motor.





At left above is bottom view of assembled boiler and cab. Screw in front and solder at rear hold it to frame. At right is bottom view of the assembled 12-volt DC motor and the frame.

uncoupling pin of an HO automatic coupler. You can turn one, if you don't have a lathe, by holding a file against a bit of brass rotated in a drill chuck. The bell may be bought or shaped from plastic or wood. To support the handrails, drill holes in the boiler and pass pins through. Solder the pins inside the boiler. Make the rails of stiff wire.

I fastened the completed boiler and cab assembly to the chassis by one screw below the front of the boiler and by soldering to the frame at two points beneath the cab with bits of brass sandwiched between. Two 1/16″ struts are soldered to boiler and apron.

Strict scale requirements call for 40″ spoke drivers, which should measure ¾″, and can be bought in that diameter for HO gauge, mounted on axles. However, I used slightly larger drivers to give the engine a greater scale speed for the gear set I had. One wheel of each pair is insulated. These go on the left side of the engine. Bend the spring wire to exert gentle pressure against the tires of the insulated wheels, but not so much that it will bind on the drivers. To insure good grounding of the uninsulated wheels, solder two pieces of wire to the frame on the right side of the engine. Bend these pieces so as to contact the uninsulated tires.

Before mounting the drivers, thread them with a 1-72 or 0-80 tap for the screws to hold the side rods. Cut and file the side and drive rods from 1/32″ steel and drill them for the screws. These holes must be exactly the same distance apart as the axle centers. You can simplify the job by drilling the holes slightly farther apart and then bringing them to the correct distance by bending the rods. Correct spacing of the drive rods to bring them in line with the cylinder centers can be accomplished by using small beads or tiny washers cut from plastic tubing and by bending an offset.

There are a couple of ways you can prevent the screws holding the drivers from backing out when the engine is run. Incompletely thread the holes so the screws will bind, or spot a bit of solder on the end of the screws after they're in place. The simplified crosshead is a bit of tubing that slides on the guide with a rectangle of brass soldered to it. The drive rod is soldered to the shank of an escutcheon pin free to pivot in the crosshead. A following issue will cover building the tender and cars and painting the train. END

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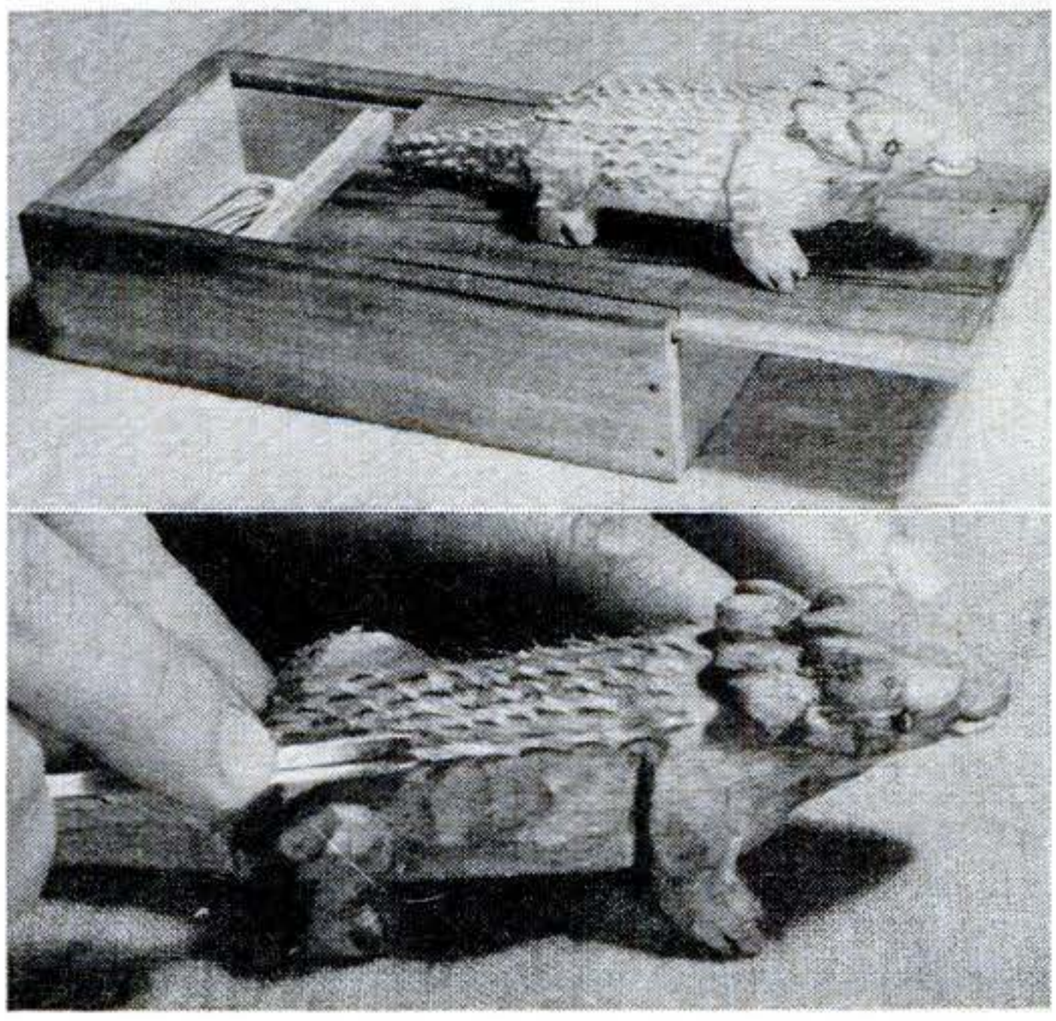
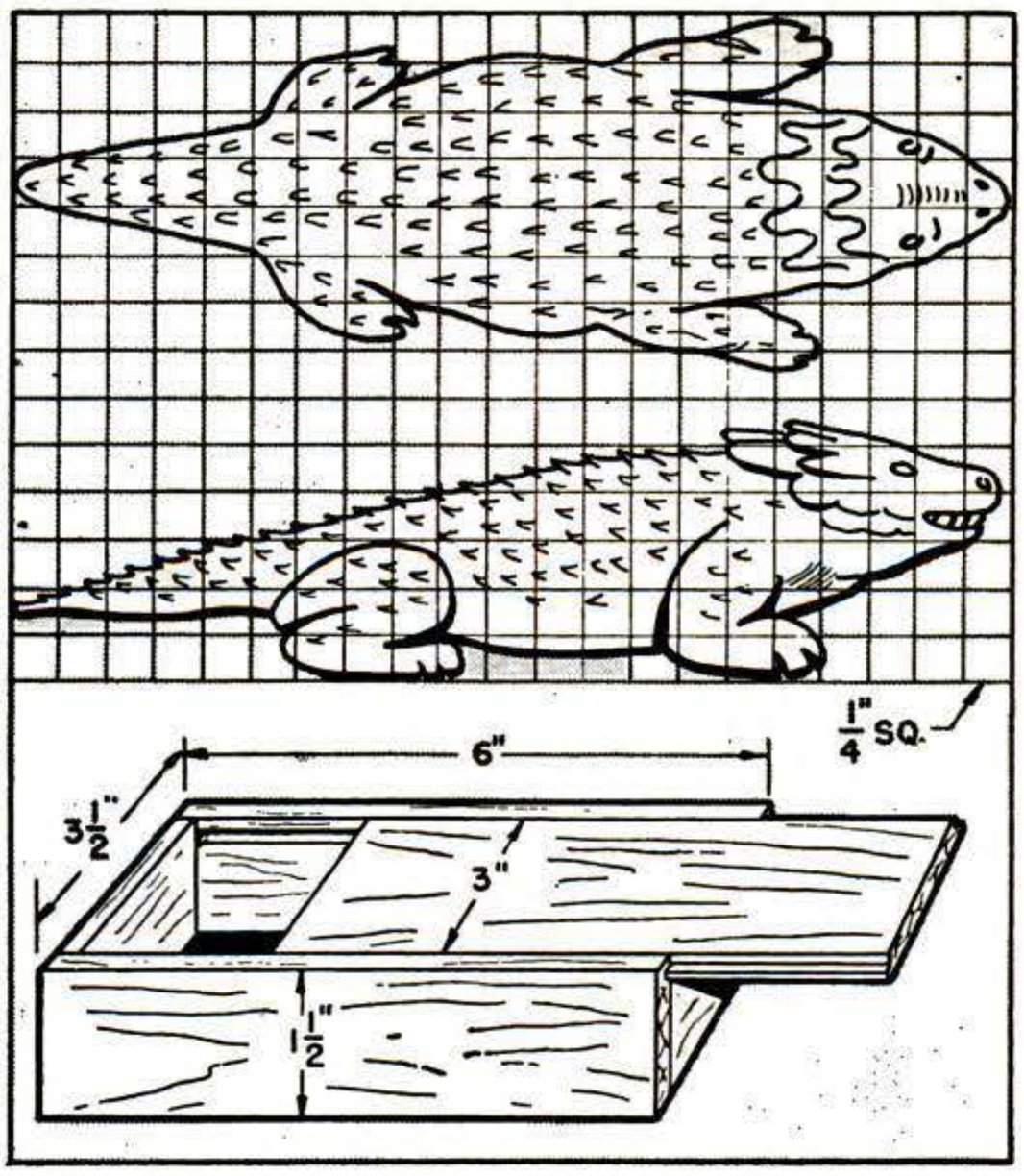
Carved Horned Toad Decorates Desk Box



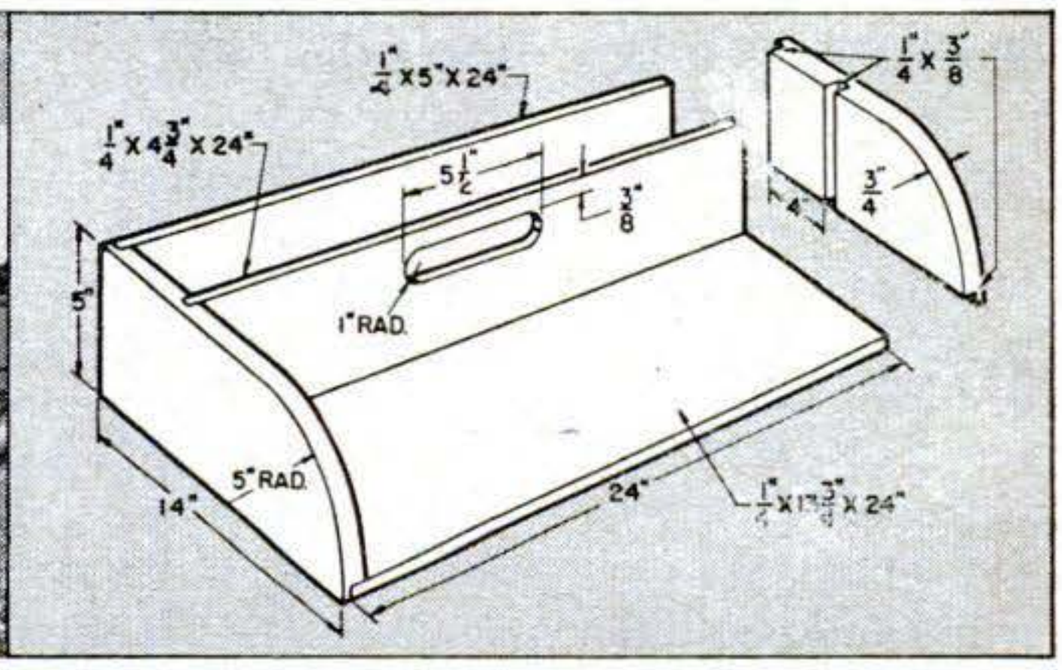


AN INTERESTING carving project, the engaging little monster pictured above decorates the box and also serves as the lid handle. Carve it of fir, poplar, or some other wood that doesn't split easily.

First lay out the figure and saw it to shape. For the present, never mind the spines; they are taken care of later. After carving the horns on the head, shape the legs and body. Then sand the carving and paint the entire piece a dull, grayish green. Ordinary water colors work well, penetrating the wood to a shallow depth. Give the mouth a row of white teeth.

When the figure is thoroughly dry, it's ready for the spiny armor. This is done with a V-shaped carving chisel. Push the chisel point into the wood (see lower photo) and raise the chisel just enough to cause the tip of the spine to stick up. Don't raise it high enough to break the wood. Put spines all over the back, legs, and sides. You'll probably find that paint penetrated under the spines.—*Elma Waltner, Hurley, S. D.*

Padded Tool Tray Protects Gardener's Knees



ALL your small garden implements are kept together for easy carrying in this tray, and the soft cushion protects your knees from bruises. I built the one shown here of ¼" and ¾" stock and decorated it with decals.

Cut out the ends and saw them to shape. Then cut the dadoes and rabbets as indicated in the drawing. After sawing the 4¾" by 24" divider to size, lay out and drill two 2" holes. Cut out the waste between them to form the handle and sand off the sharp edges. Assemble with brads and waterproof glue. Sand and paint the tray.

Install the cushion after the finish has dried. Tack a 14" by 30" piece of imitation leather along the divider 2" from the bottom. Fold down and tack the excess 3" at each end. Slip a 2" piece of foam rubber into the pocket formed by the tray bottom and leather. Pull the other edge of the leather under the tray and tack it. You can substitute cotton padding for the rubber.—*Whitney K. Towers, Los Angeles, Calif.*

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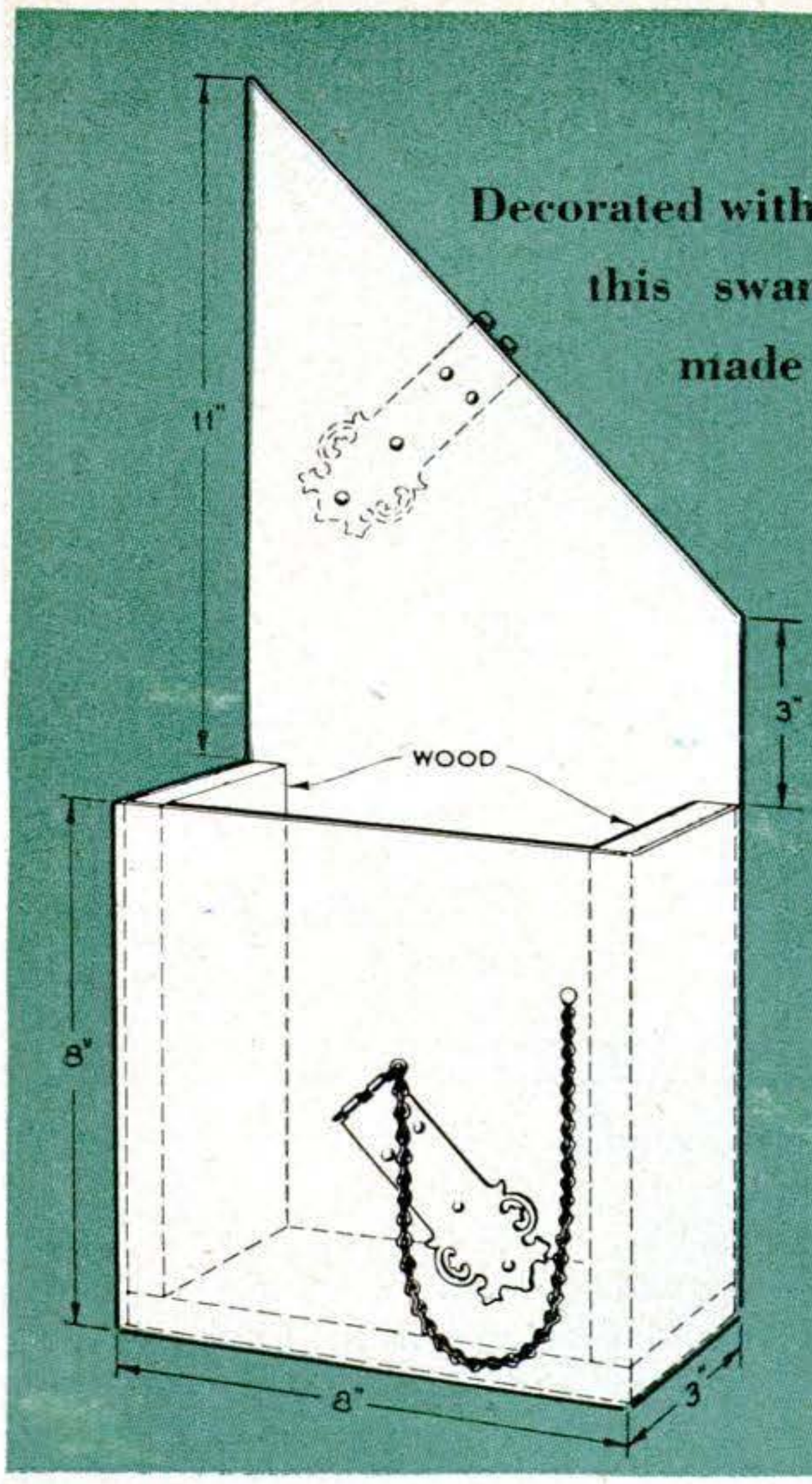
Decorated with brass tacks and hinges, this swank gift outfit can be made with only simple tools.



Dimensions and construction are shown in the drawing and the completed set in the photo. Materials used were a few square feet of leather, three pieces of plywood, and the hardware.

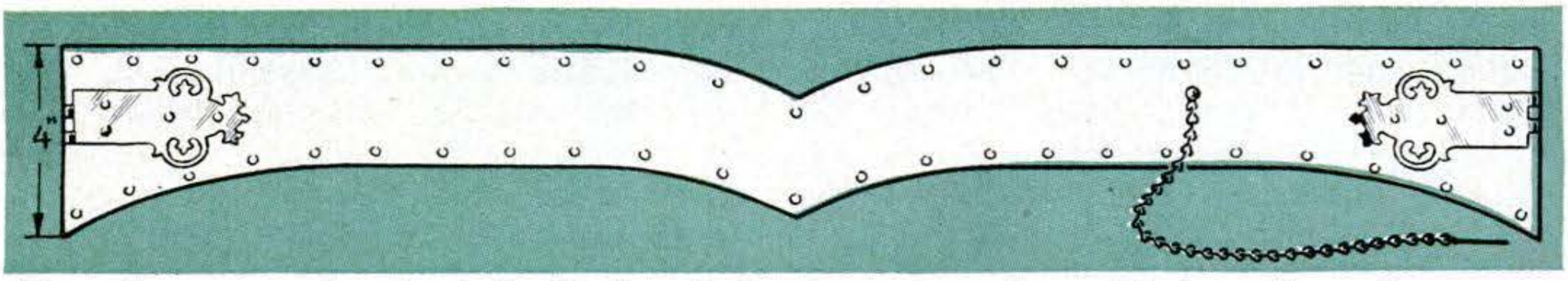
Bag and Belt Set

By Myles De Russy, Jr.

NEXT time you want to present a gift, save yourself several dollars with this bag and belt set. It's a handsome but simple project. The cost of the materials is small compared with the price of a similar commercially made set. I turned out this one with only hand tools in three evenings.

Chances are you already have all the tools you'll need—a linoleum knife, hammer, side-cutting pliers, and a leather punch. If not, the punch is probably the only extra tool you'll need to buy.

Shop carefully for the leather. I bought mine from a company that supplies shoe repairmen. A good bet is a shop that handles craftwork supplies. Such a store is more apt to sell you just the amount of leather you need rather than an entire hide. Select a good cowhide of medium weight. The back or side—not the belly—is best for a bag and



Above is pattern for the belt. No length is given since that will depend on the wearer.

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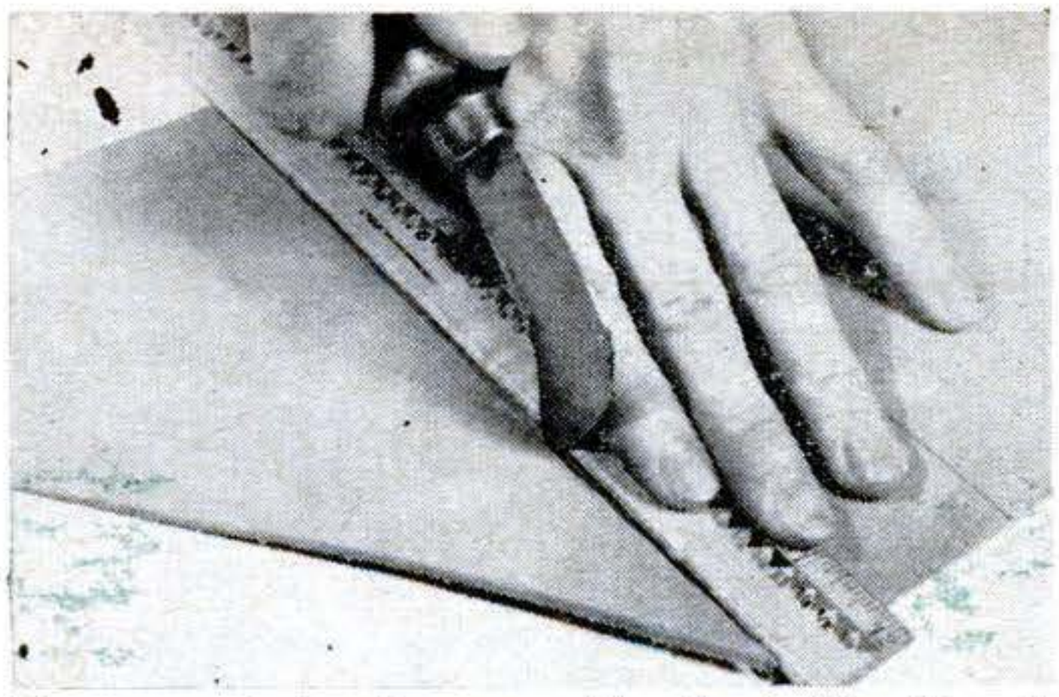
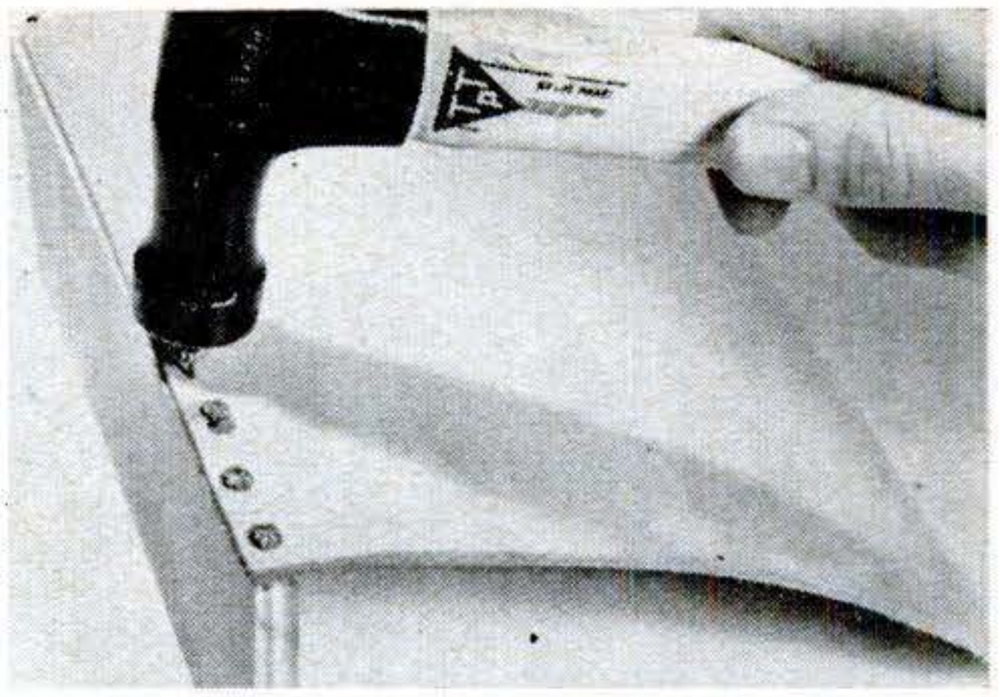
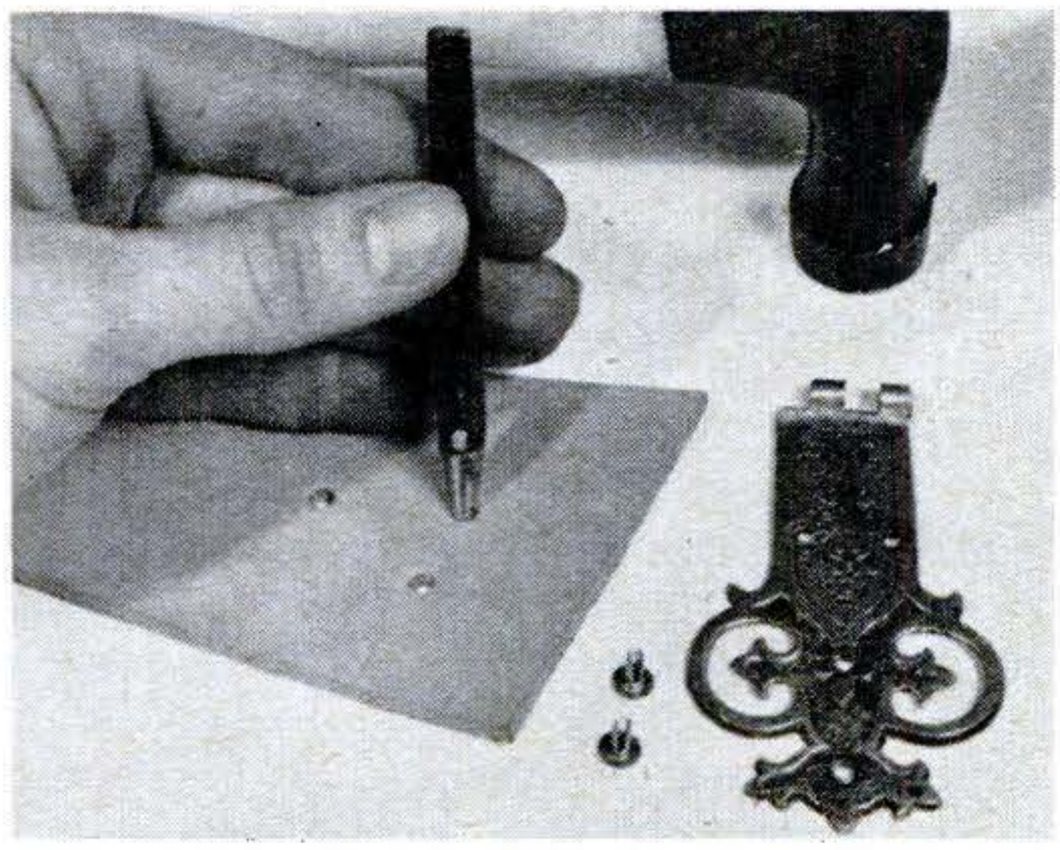


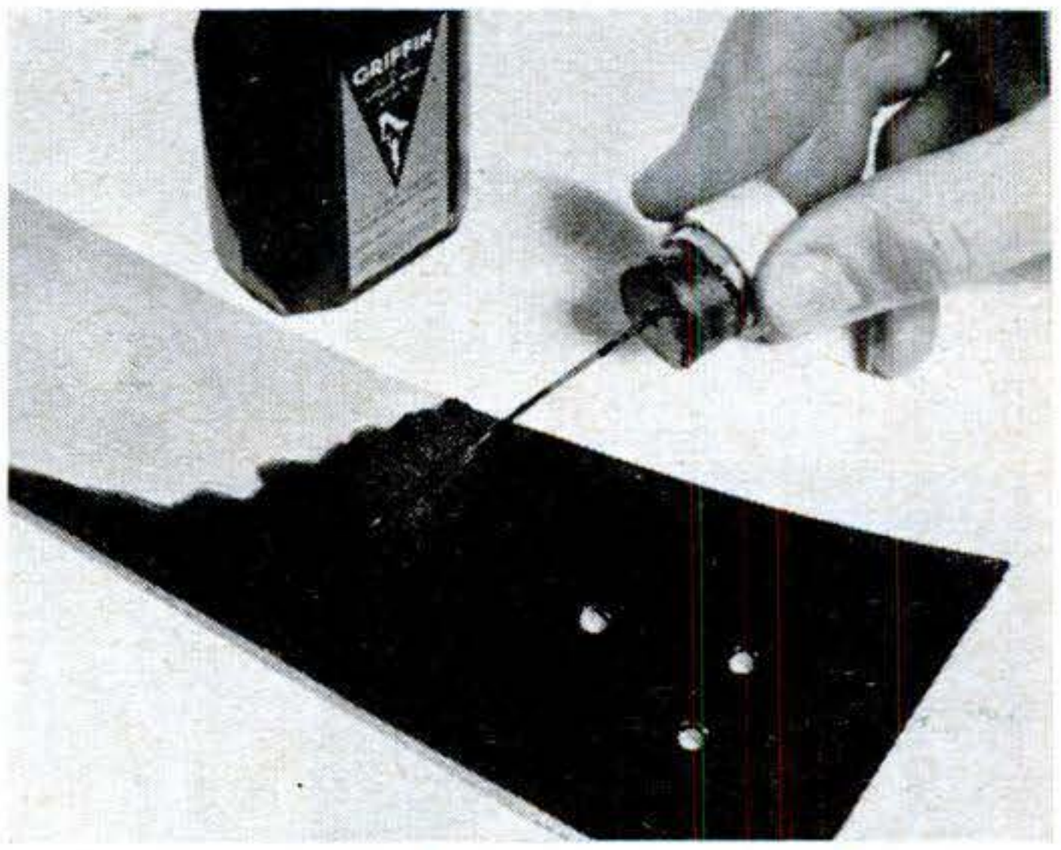
Use a straightedge to guide the knife. Pencil the pattern on the rough side of the leather.



Attach bottom, sides, back, and front to the plywood frame with brass upholstery tacks.



Hinges are held in place by small split rivets. Lay out the hole locations and punch them out.



Color the leather by applying shoe dye with a dauber. Completed set is waxed and polished.

Cut from Cowhide

belt set. Before buying, test the leather by bending it at one corner. If it cracks, it's not good for your purpose.

Besides the hinges, here's the hardware you'll need: upholstery tacks with decorative heads, about 20″ of brass chain, two cotter pins, eight small brass wood screws, and some ⅝″ brass split rivets. You can buy the hinges at a hardware store, or perhaps find an exceptional pair at a secondhand or antique shop. Be sure that they are brass to match the other hardware. Knock out the hinge pins. The cotter pins will take their place, acting as catches on the bag and belt.

The drawings give you all the dimensions except the length of the belt. That'll depend on the wearer. Lay out the patterns on paper and then transfer them to the cowhide. Use a pencil to trace the outline on the rough side of the leather.

Make the belt first. When cutting along a straight line, use a ruler. Draw the knife slowly along the edge. With a sharp knife, you'll have no trouble cutting the skin. Position the two parts of a hinge on the ends of the belt and lay out the holes for rivets. At this point, dye the leather. I applied ordinary shoe dye with a dauber.

The decorative tacks on the belt are spaced about 1″ apart and ¼″ in from the edges. Push all the tacks through. Turn the belt over and snip off the ends with the side-cutting pliers. Cut the ends off close to the leather. Then turn them down with a hammer. To complete the belt, rivet the hinge in place and attach the chain and cotter pin.

The three pieces of wood that form the frame can be cut from ¼″ to ½″ plywood or hardwood. Screw them together and line the pieces with velvet or suede. Glue

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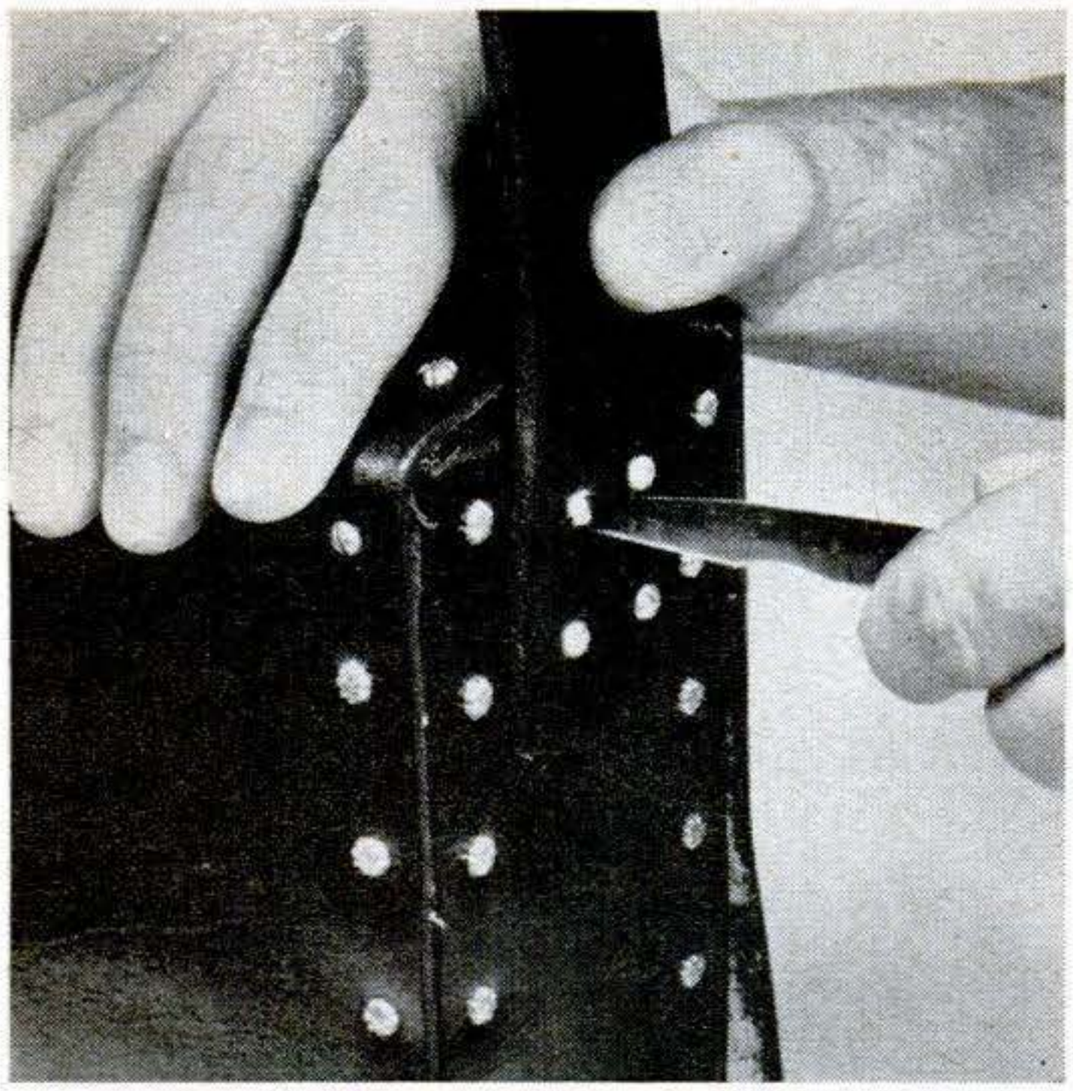

Secure the ends of the shoulder strap to the sides of the bag with screws into wood frame.

Fasten the hinges with split rivets. The ends of the chain on bag and belt also are riveted.

will hold the lining. Then you're ready to tack on the five pieces of leather. First, however, clamp the front and back pieces in place and mark the locations for the hinge holes. Punch these holes before tacking on the leather. Tack on the sides and bottom, overlapping the edges with front and back.

Cutting the shoulder strap is easy. Use two pieces of leather each about 2′ long. Suit yourself about the width. Dye them and attach a brass buckle to an end of one strap and punch holes in an end of the other strap to suit the buckle. Fasten the ends of the strap to the sides with brass wood screws. Use screws long enough to penetrate well into the wood but not so long that they'll go all the way through.

Now you can dye the bag. But first be sure to thoroughly clean the leather. Buy a leather-cleaning solution at a supply house and follow the directions. These cleaners usually are applied with a cloth. After removing the dirt and grease with the cleaner, you can apply the dye. I used shoe dye, but you can buy special dyes for leather if you like. The most common of these are aniline dyes in powder form that are dissolved in hot water. After mixing, test the dye on a scrap before applying it to the set.

As I dyed the bag, I kept a rag handy to wipe off the tack heads and hinges. I rubbed on a coat of ordinary floor wax and used plenty of elbow grease to give the leather a high gloss. Steel wool or brass polish will shine up the hardware. END

Small Tractor Turns In Man-Sized Performance

JOBS too small for a full-size tractor are made to order for the Agricat ®. It'll get into places that a big tractor can't, but it still does a big job. One use is in filling trenches that a regular tractor would straddle. The Agricat rides in the trench and the bulldozer blade on the front spreads the fill. The two 6″ tracks contact 318 square inches of ground. Only 38″ wide and 58″ long, the midget stands 41″ high and weighs 1,170 lb. A 60-hp. engine with two forward speeds and a reverse powers the tractor. Made by Earl H. Pence and Co., Inc., Berkeley, Calif., it's priced at $875. In the photo at right, the tractor is shown pulling a 12″ plow that cuts a 10″ furrow. The swinging drawbar is set so the tracks ride out of the furrow. A manual lift raises the plow so it can be backed into corners.

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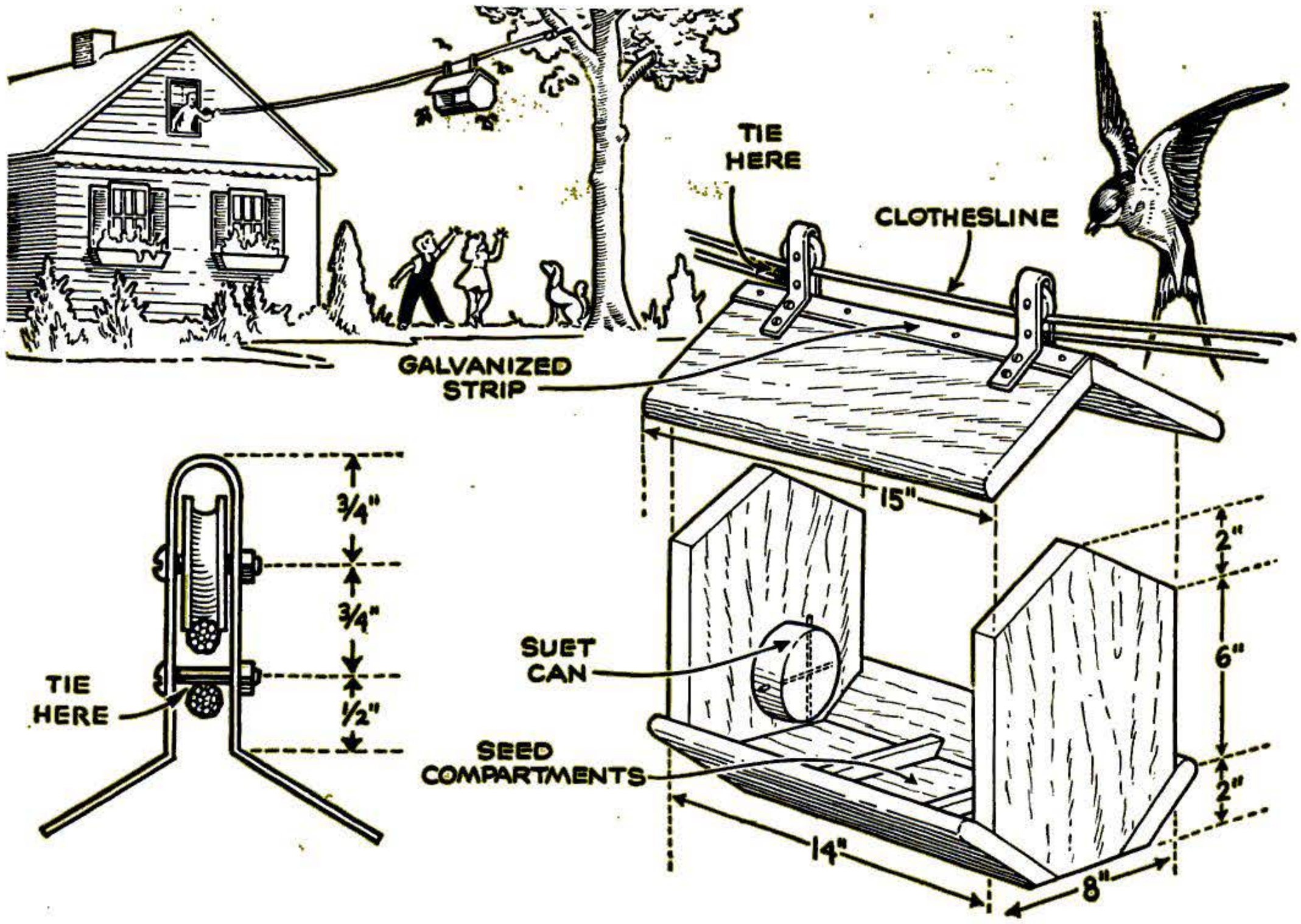


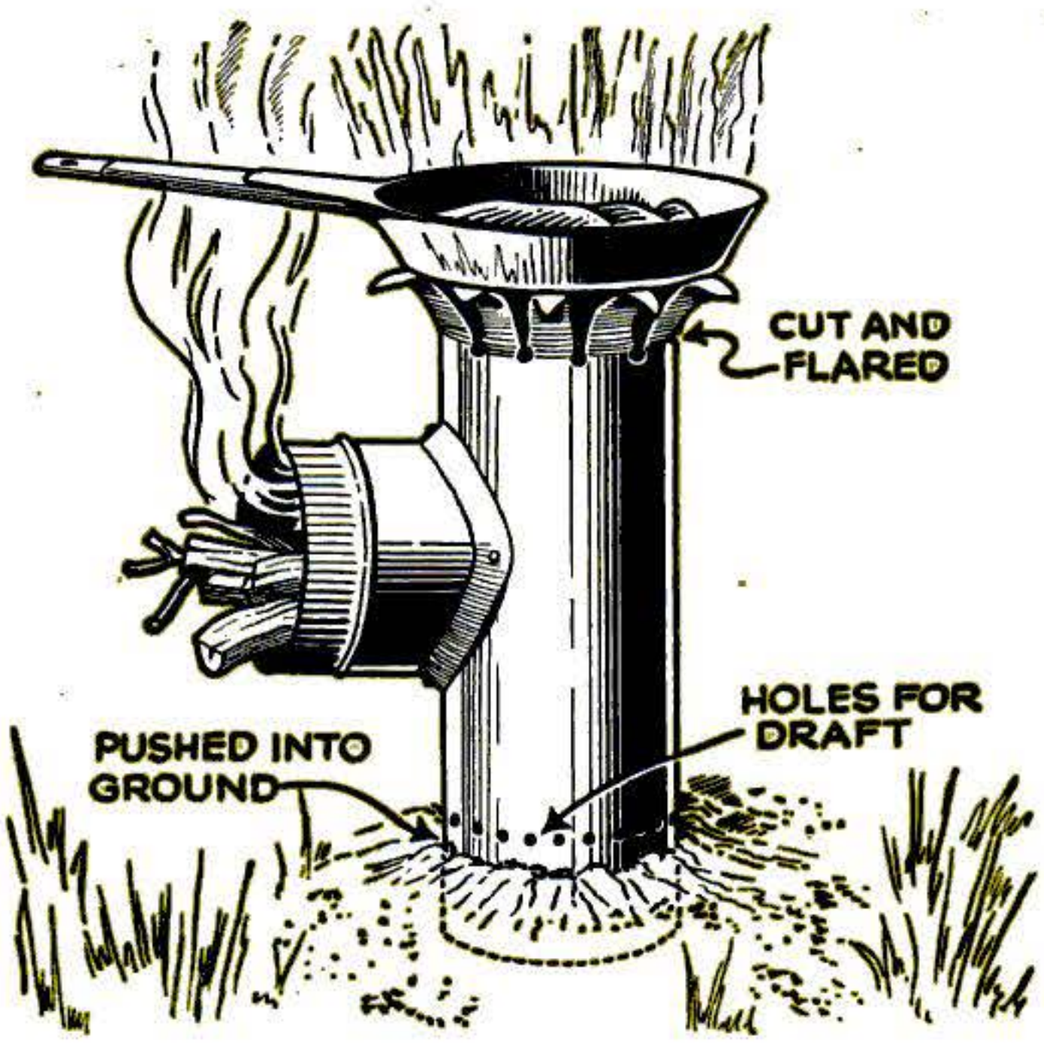
Trolley Feeder Draws Birds Close to House

WHEN this feeder is first installed, it should be left at some distance from the house until the birds are thoroughly familiar with it. Then, when they are coming regularly for their food, you can pull it closer to the house each day. Finally, the birds will be feeding right outside your window. Of course, the feeder must be pulled in from time to time to refill the seed compartments.

Use ¾" material for weight so the feeder won't swing too much in a breeze. Shallow partitions are installed to prevent the seeds from piling up at one end. Suet is secured in a small can by a couple of wires run through at right angles. You can paint the feeder or just give it several coats of boiled linseed oil and let it weather. Note that both sides are open and the corners of the eaves and floor sidepieces rounded. Hangers are light strap iron.—*Hi Sibley, Nuevo, Calif.*

Pipe Tee Forms Camp Stove

LIGHT and easy to carry, this little stove is ideal for short camping trips. It fits snugly into the trunk of your car or, on an overnight hike, it adds but little weight to a pack. An ordinary stovepipe tee is altered as shown in the drawing at right. The top is slit and flared so it'll take a large frying pan or a kettle. Holes are punched around the bottom to create a draft. These should be about 6" from the bottom of the pipe. Pushing the bottom end into the ground makes the stove stable. You can adjust draft by blocking some of the holes with earth. When you stow the stove in the car trunk, use the inside of the pipe to store dry kindling.—*Victor H. Lamoy, Upper Jay, N. Y.*



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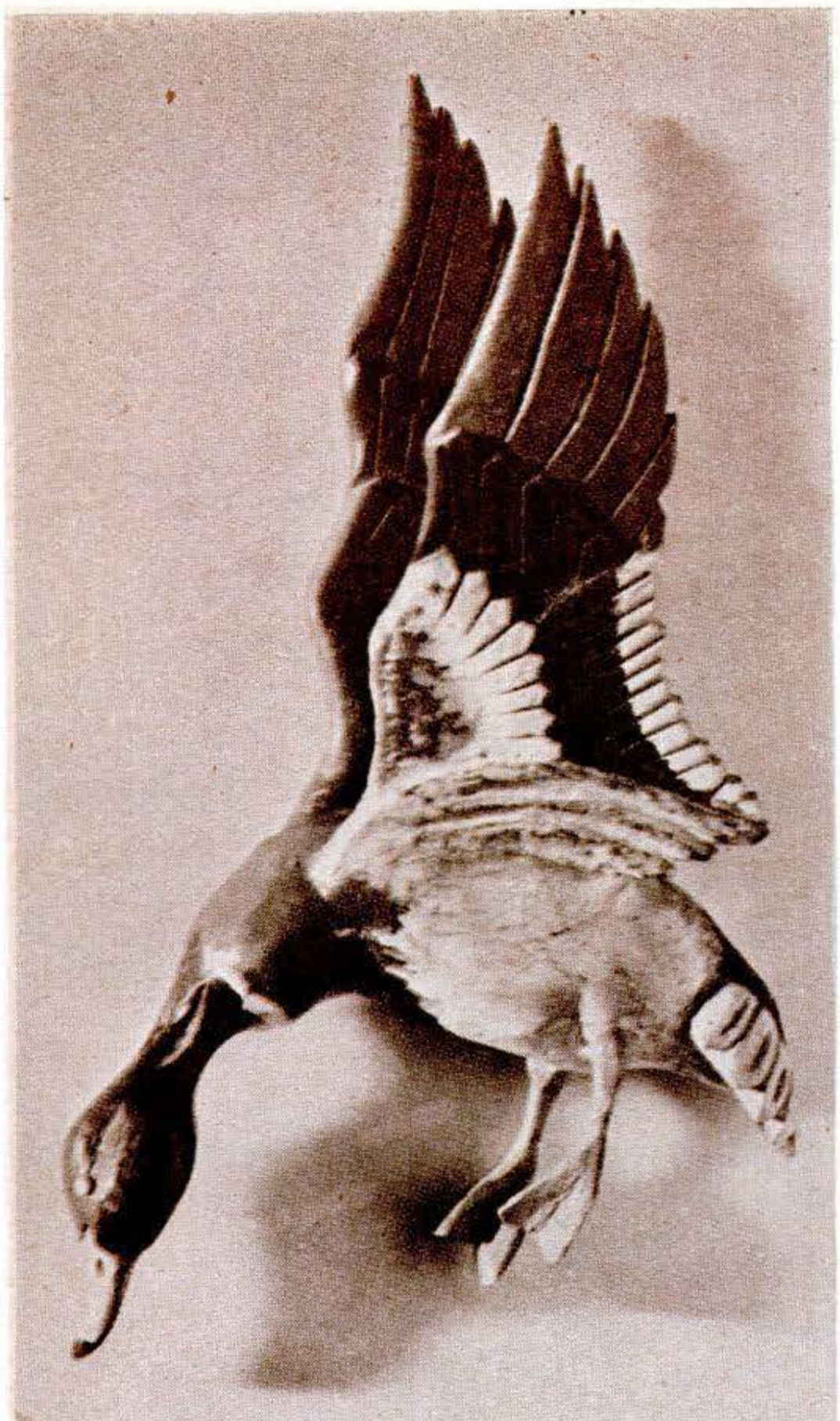


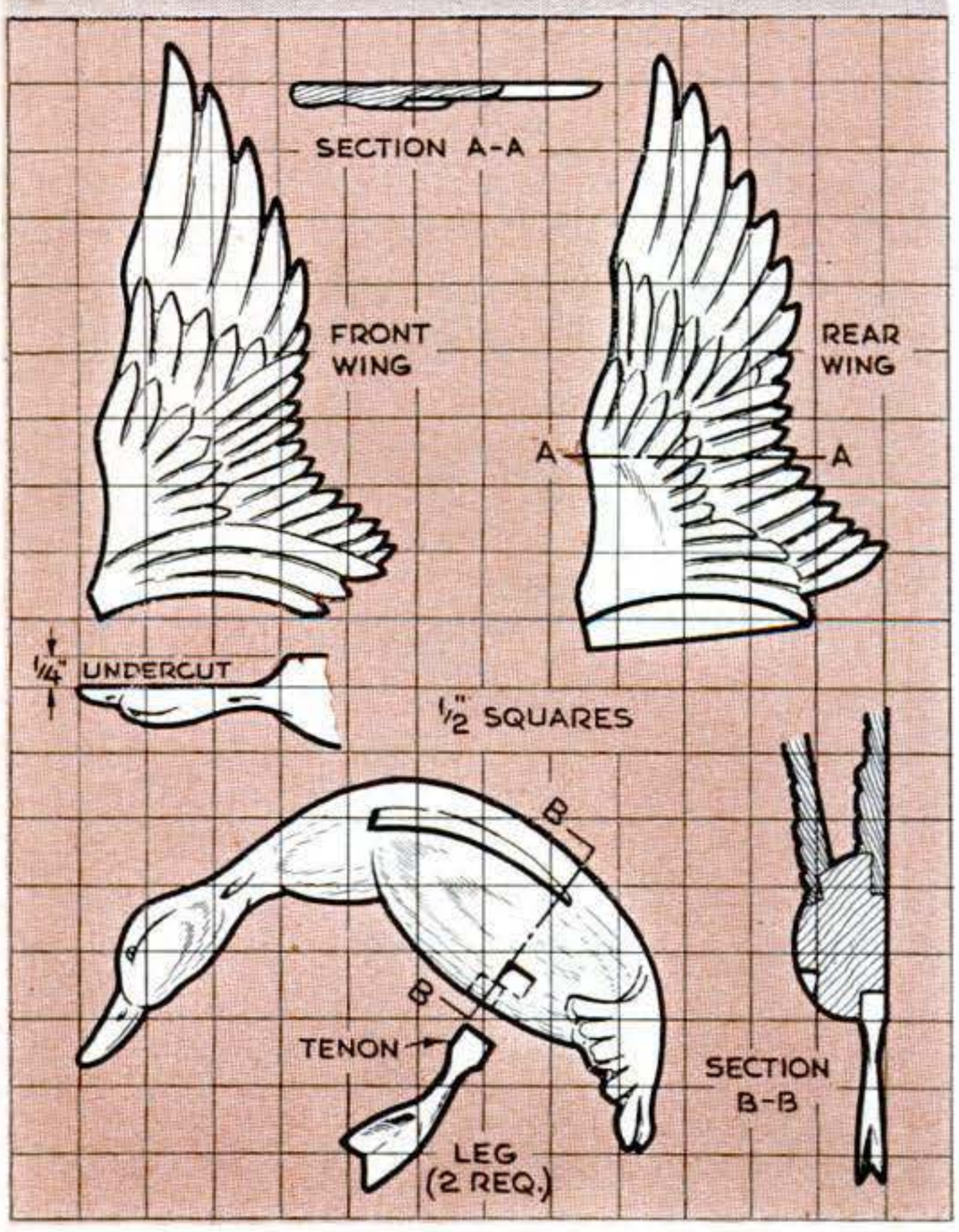
Miniature Game Bird Whittled from Pine

A GAME bird in flight isn't as difficult a carving project as it may seem. Actually, if done as suggested here, it's quite easy. Painted in natural colors, it brings a nice touch of outdoors to your den or living room. It has a flat back for wall mounting but looks like a full-round carving.

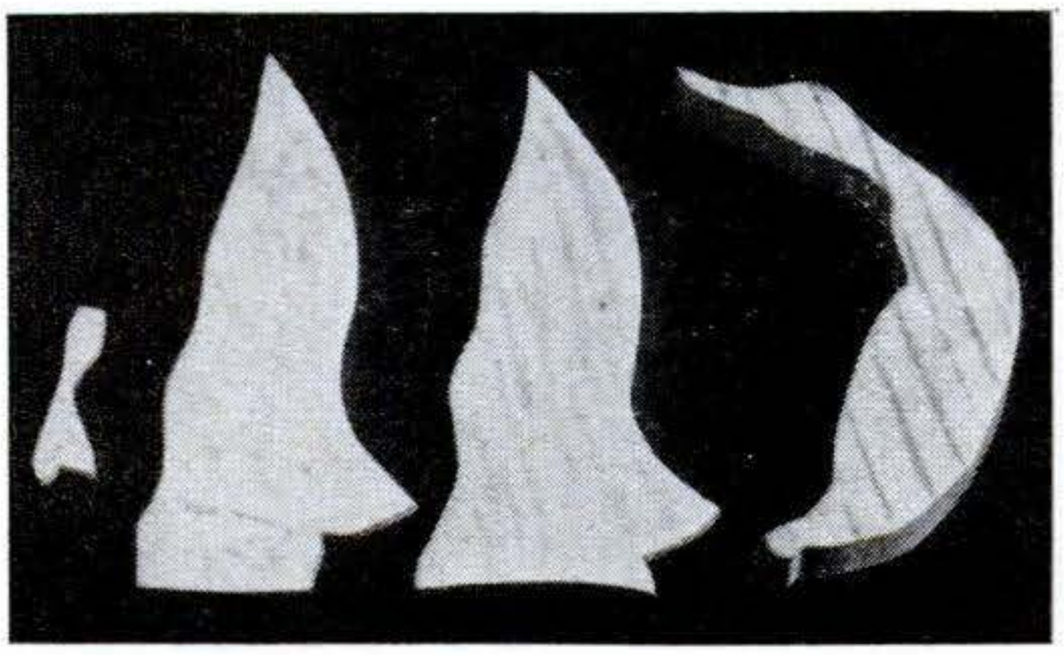
You begin by transferring the patterns to white-pine stock and roughing out the five pieces, body, two wings, and two legs, with a saw. Use ¾" stock for the body, ¼" for the wings and legs. Cut each piece with the grain running lengthwise.

Start the body carving by making a ¼" undercut back of the head and neck section. Then round out the body, paying particular attention to the shape of the head, neck, and bill. Muscles in the neck can be simulated by U-shaped grooves. Shallow cuts outline the tail feathers.

For each wing, outline the rows of feathers on the blanks with a pencil. Make a cut 1/16" deep at the start of each row. Taper the feathers upward from this point, keeping them the full thickness of the blank at or near the tips. Round off the tips of the



Body and wings are carved only on one side. A ¼" undercut brings head and neck away from background. A glass bead serves as the eye.



Roughing out the pieces with a saw saves a lot of whittling. Use ¾" stock for the body, ¼" for the wings and legs. Note how grain runs.

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top bank of feathers and bring them to a graceful point. Outline all the feathers with shallow V-cuts.

The feet have an X-shaped cross section. Be sure to leave enough wood at the top of the legs for a tenon.

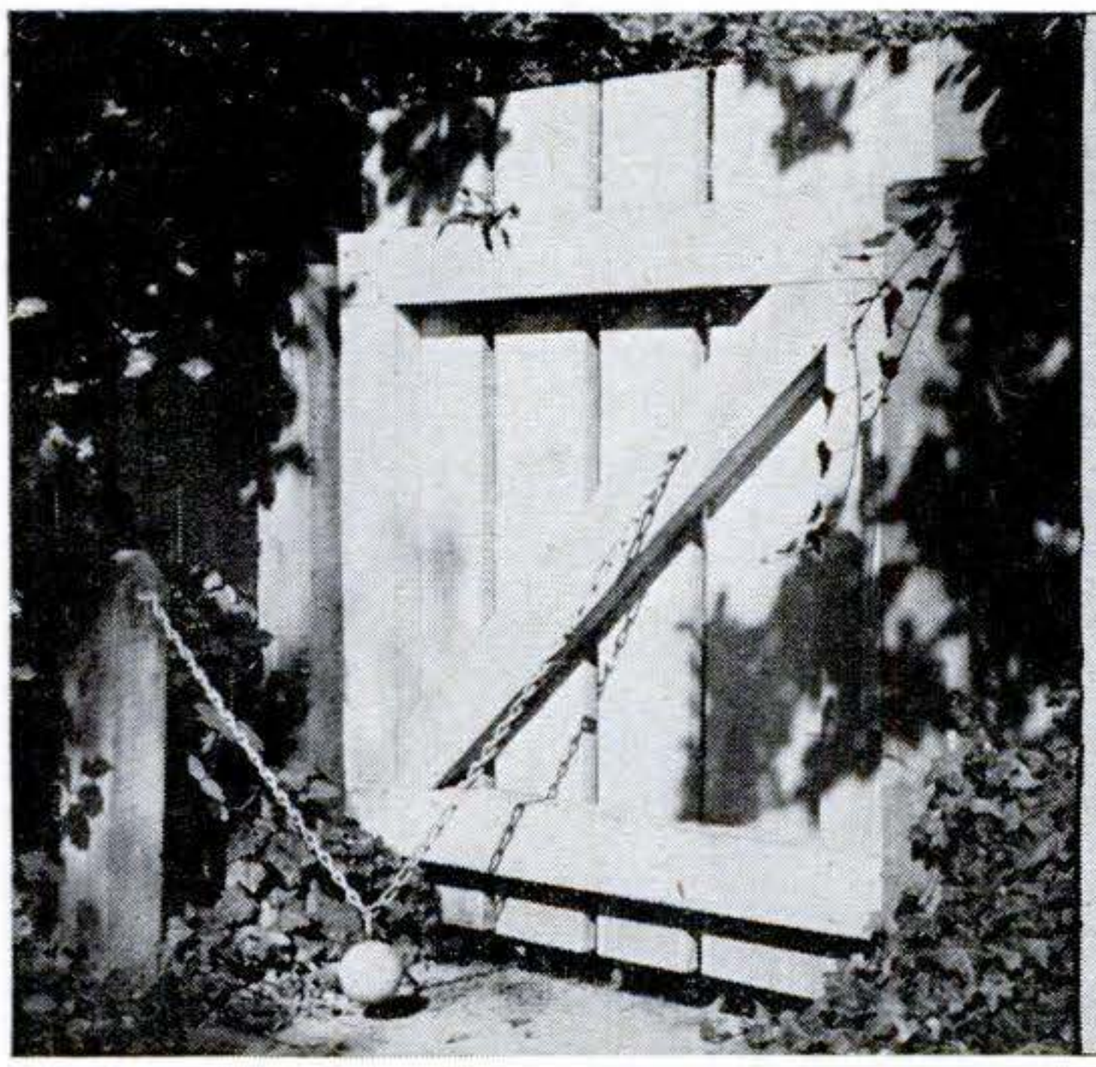
Cut the leg and wing mortise-and-tenon joints to a snug fit. After all parts have been sanded, glue them together. Use a little plastic composition wood to smooth over any apparent joints. When this has set, sand the bird again and apply a coat of flat white paint.

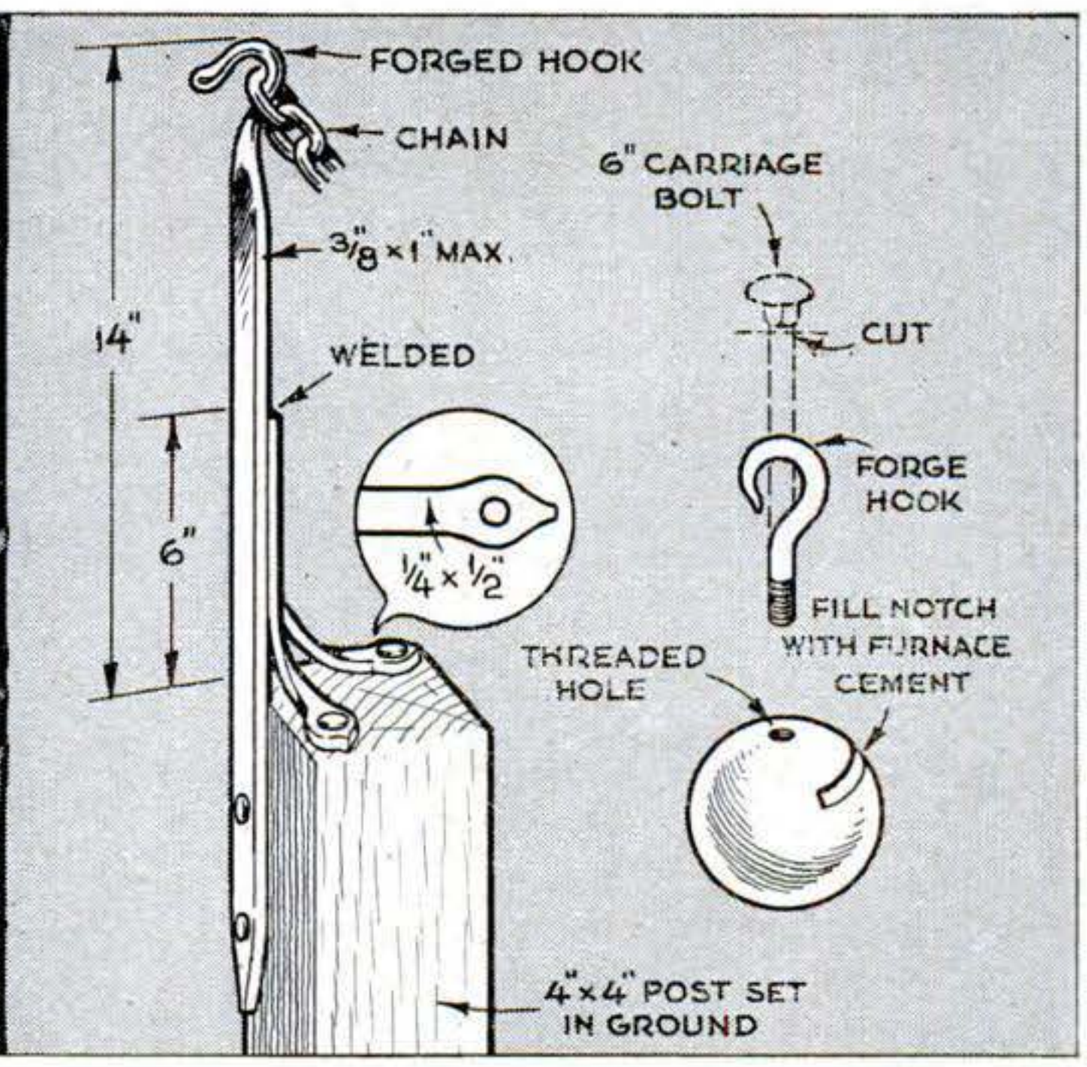
The finish coat may be either enamel or oils. If you're uncertain of the colors, you can probably locate a colored illustration of a mallard without too much trouble. Use a small yellow glass bead for the eye.

Attach a hanger on the back at the center of balance.—*M. P. Casserly, St. Paul, Minn.*

Wings vary slightly since you see different sides. Plastic composition wood hides joints.

Colonial Gate Closure Uses Furnace-Ball Weight





If you've ever visited Williamsburg, Va., you may have noticed the gate shown in the above photo. It's kept closed by a heavy ball on a chain. The chain is stapled to the gate and a strong post set near-by.

For your own yard gate you may like the more elaborate staff in the drawing. You can make this yourself if you do blacksmithing. Mount it on a low post with matching forged nails. A furnace damper-control ball can serve as the weight. Forge a hook from a 6" bolt and turn into the threaded hole.

Steel Wool in Electric Drill Polishes Wood

For a fine wood finish, especially in crevices and on end grain, I wrap fine steel wool around a dowel and chuck the dowel in my high-speed electric drill.

Spread out wool about 2" wide and 4" long. Wrap this around a 3/16" or ¼" dowel about 7" long. Start up the drill and brush the wool-wrapped dowel lightly against scrap wood to make the wool stick. Then apply another layer. Keep a light touch while using it. Wear goggles or a mask.—*Roland Krebs, Webster Groves, Mo.*

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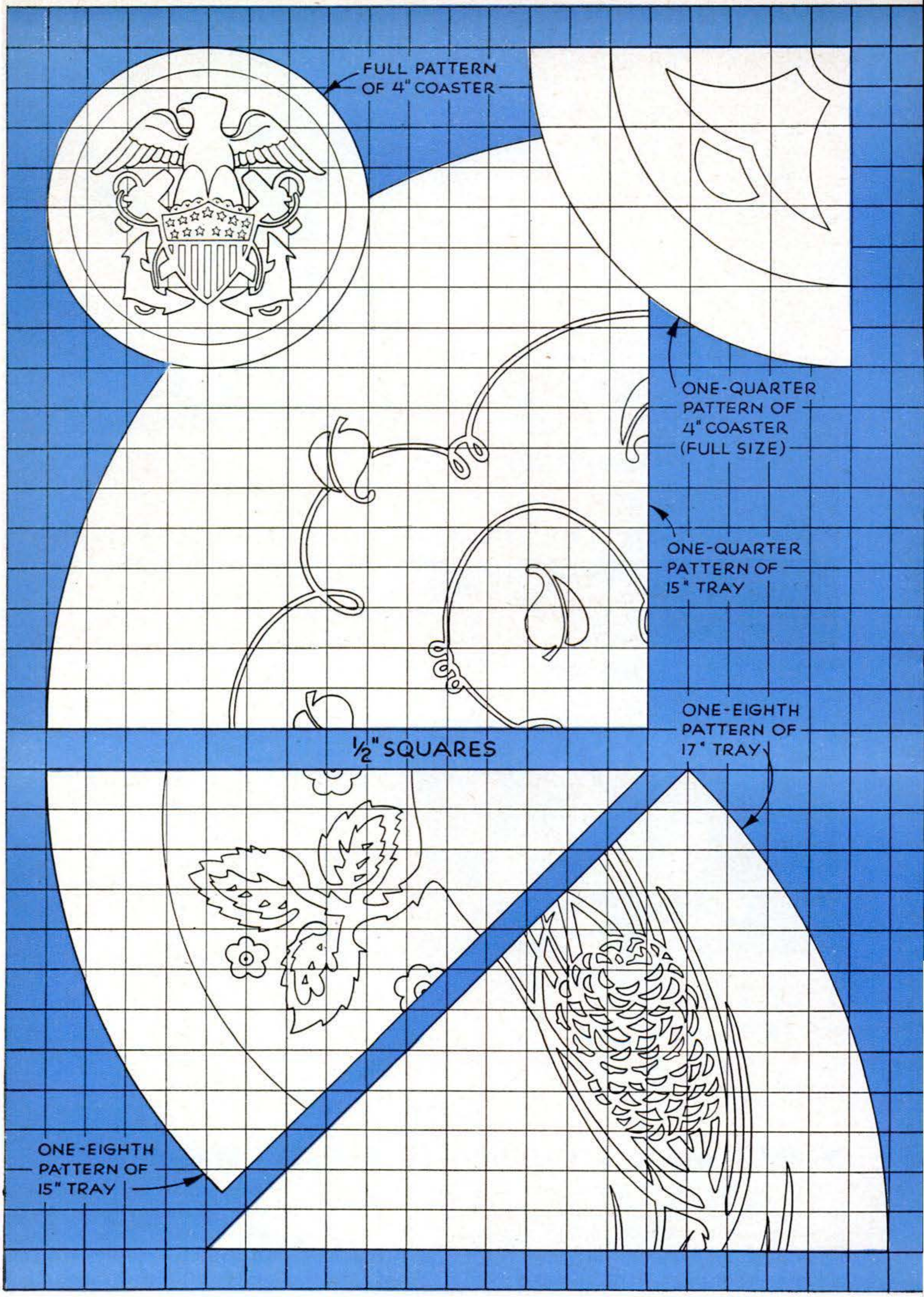

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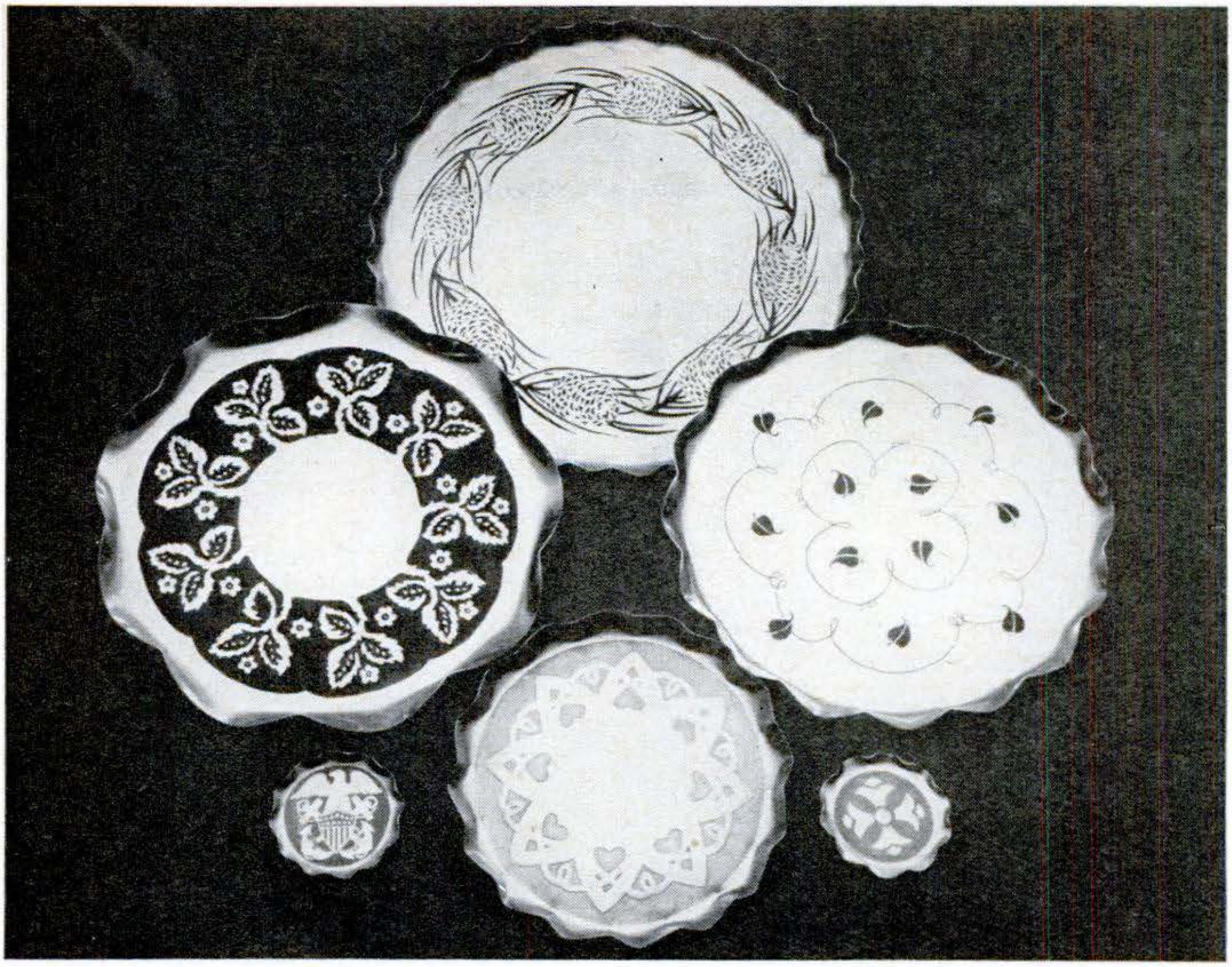

Aluminum disks etched with patterns of your choice make good coasters, plates and trays.

How to Etch Aluminum

By Carolyn Plucknett

and Grace Schoeni

DECORATING aluminum is one hobby you can be sure your wife will approve. With a little encouragement she may even join you in adorning those inexpensive metal disks. In various sizes, finished aluminum circles make eye-catching coasters, ashtrays, candy or nut dishes, centerpieces, and cake or sandwich plates. When you have all you want, remember that etched aluminum trays are original gifts for almost any occasion.

Acid etches aluminum by uniformly attacking any part of the surface that has not been protected by an acid-resistant coating. Protected parts are thus left in relief. Of the major items of equipment, muriatic (hydrochloric) acid, and an acid-resistant substance such as asphaltum paint or varnish can be purchased from your local drug and paint stores. Aluminum circles from 2″ to 22″ in diameter are available from handicraft suppliers. Best thickness for the larger trays is 16 gauge; 18 gauge is adequate for medium and small disks.

Remove the oily film on the aluminum with a scratchless scouring powder, and polish the surface with No. 0000 steel wool moistened with mild soap. Follow any apparent grain in the metal in both cleaning and polishing strokes.

A simple way to plan a pattern is to cut a paper circle the size of the disk. Fold the paper into equal parts; the fold lines mark the points at which scallops in the rim will be turned up. Make the rim deep enough to hold the acid. For coasters and up to 15″ disks, a minimum of 10 scallops will

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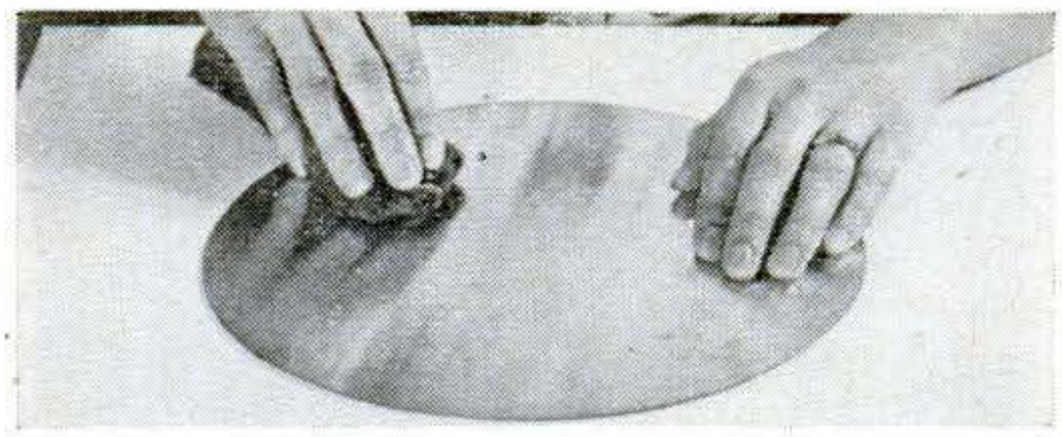
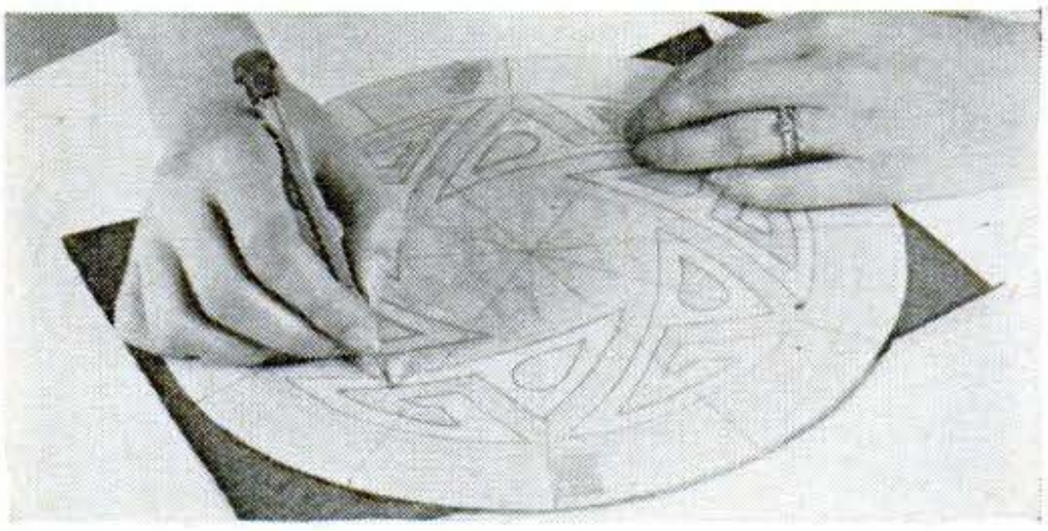
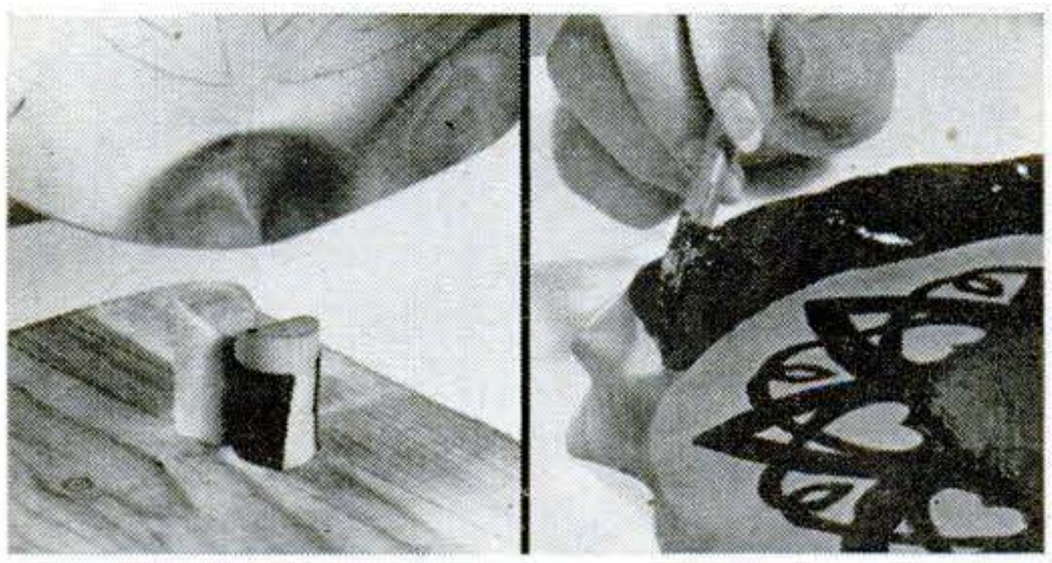


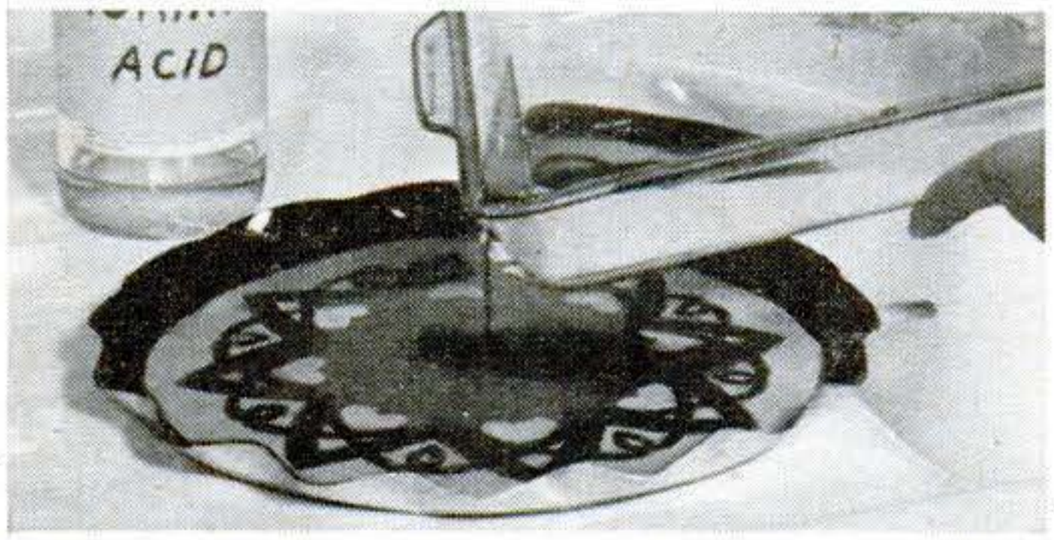
Polish the aluminum with scouring powder and a pad of steel wool loaded with mild soap.



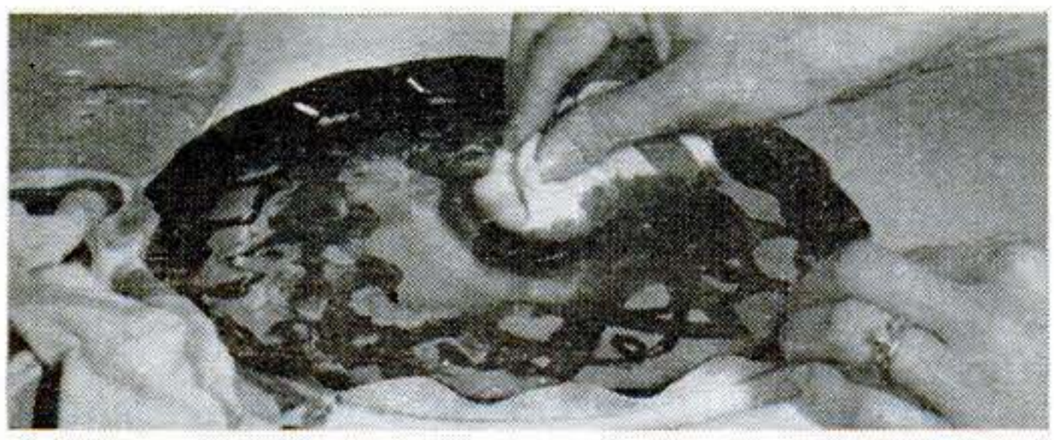
Work out the design on paper, tape it to the aluminum, and trace it off with carbon paper.



A bending jig, left, made from two dowel pegs and a scrap of wood assures uniform scallops. Paint the rim and the relief decorations with acid-resistant paint or varnish as at right.



Mix a solution of water and muriatic acid in a glass vessel and pour it onto the aluminum.



Remove the asphaltum from the etched tray with cleaning solution, applied with a soft cloth.

be needed, while larger trays require 16 or more. Draw a circle on the pattern to allow for the depth of the rim and plan the design within that circle.

A geometric design is easy to make with a ruler and compass, and the center decoration can be a monogram, emblem, or a traced picture. After working out the pattern (several are drawn to scale on page 200), transfer it to the aluminum with grease carbon paper.

Turn up the edges next to form the rim. This can be done with pliers if the jaws are well taped. A bending jig made from a scrap-wood base and two 2″ pegs cut from ½″ or ¾″ dowels will form smooth and uniform curves. Drill two holes 1″ deep to fit the dowels, placing them as close together as possible. Glue in the pegs and work sandpaper back and forth between them until the aluminum edge just fits snugly. With 1″ of the pegs projecting, the jig will make uniform bends in larger trays. For smaller sizes, insert thin pieces of wood between the pegs to act as bottom stops. Three widths of these will locate disk edges ¼″, ½″ and ¾″ down from the tops of the pegs. To make a smooth rim, bend each scallop about halfway up; then go around the circle again to complete the job.

Paint the parts of the tray that are not to be etched with a thick coat of asphaltum. A small water-color brush is needed for delicate lines and a larger one for the large areas. If the asphaltum tends to run, thicken it by exposure to air. Should it get too thick, thin it with turpentine. Let the coating dry overnight. After it is dry, you can correct irregularities and draw in fine lines with a sharp point.

To prepare the etching solution, carefully pour one part of muriatic acid into two parts of cold water in a glass container. Use caution in handling the acid. Always add acid to water, not water to acid. Avoid inhaling the fumes, and work near an open window. Acid eats away metal, so don't pour waste solution down the drain.

Pour acid solution into the tray to a depth of about ¼″. If it boils too vigorously, carefully add water; if it shows no signs of boiling within 15 minutes, add more acid.

To test the depth of the etching, pour the solution back into the container, rinse the tray in cold water, and feel for a slight ridge. When the etching is deep enough, rinse and dry the tray. Remove the asphaltum with benzine and a soft cloth. END

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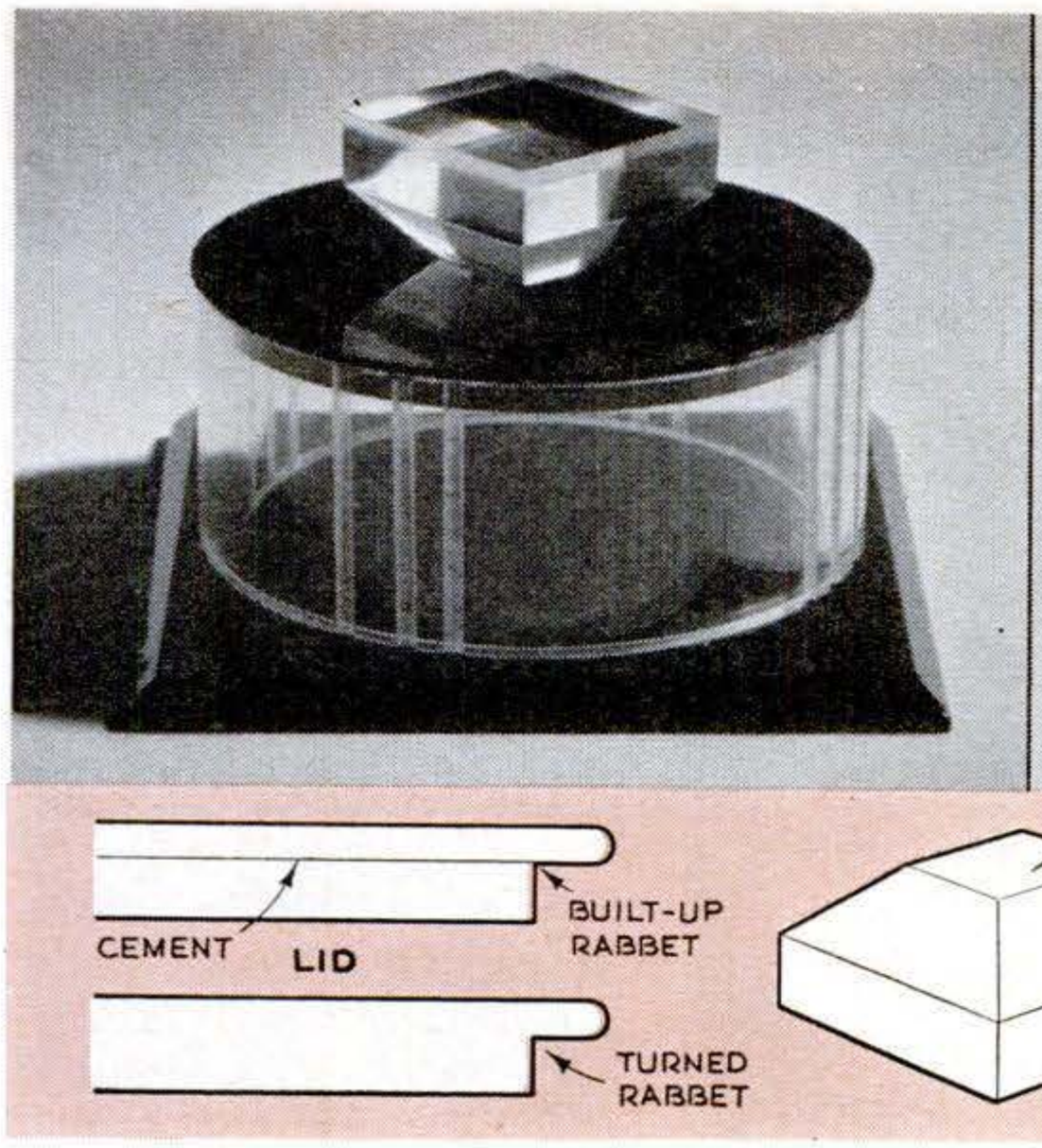


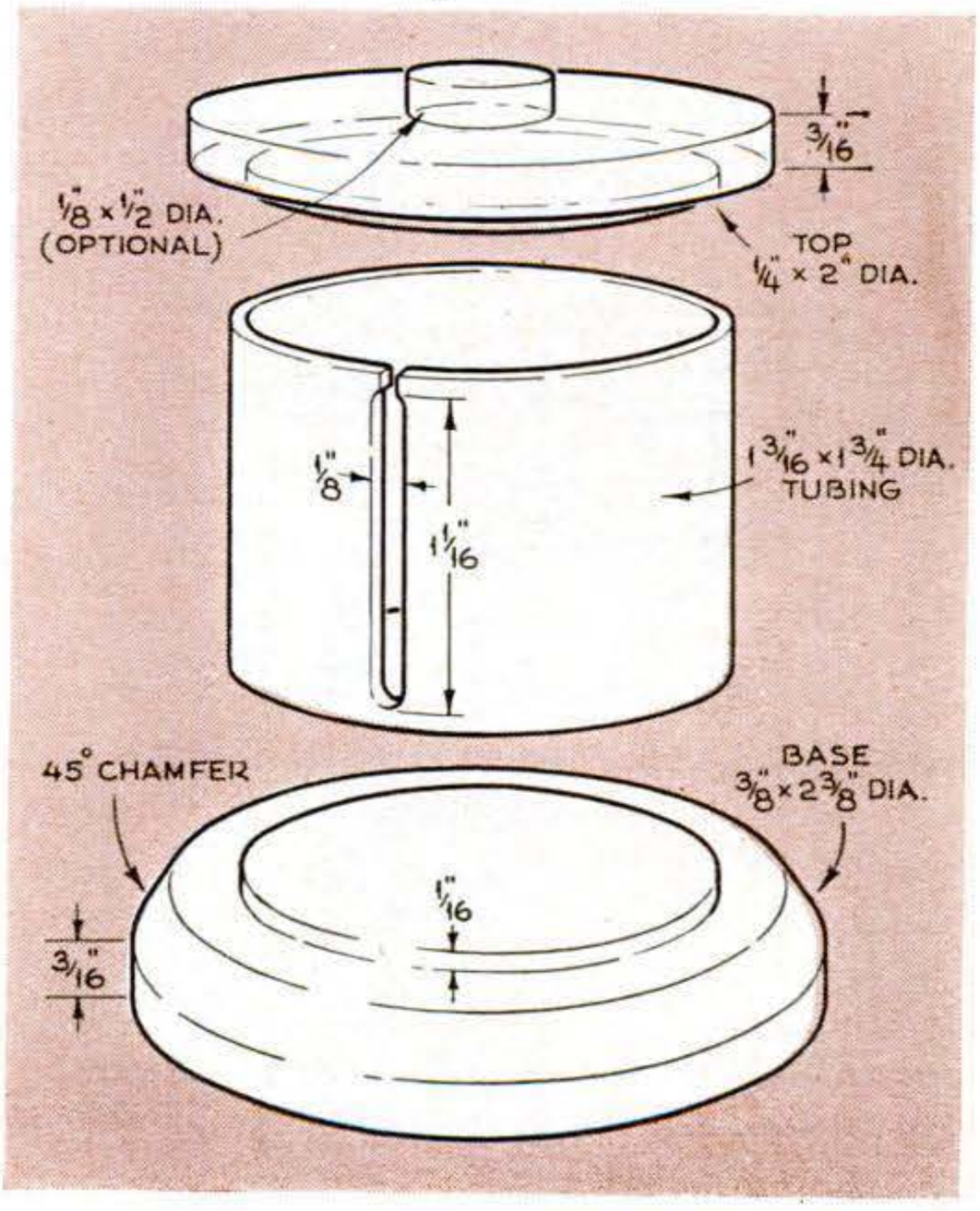
Powder Box Combines Clear and Opaque Plastic

THE body of this simple box was cut from a stock cylinder and decorated with lines scored at equal intervals. A piece of ¾" stock, faceted and polished, forms the knob. Sand or file the bevels to 45 deg. The lid may be turned and rabbeted, or sawed round and the rabbet cut by routing the edge. To make it without power tools, saw two ⅛" thick disks of different diameters and cement them together.

You'll have to cement the body to the beveled base. But if both knob and lid are opaque, they may be assembled with one screw after tapping the knob with matching threads. This eliminates an extra cementing job if you build up the lid from two disks. The screw secures disks and knob. As a variation, you can heat-shape strips of plastic to form a bow in place of the knob.—*M. J. Moch, Jamaica, N. Y.*

Roll of Stamps Stored in Desk-Top Holder

STAMPS in small books or loose sheets have an uncanny habit of getting themselves lost in a desk drawer, or else the loose ones stick to the drawer bottom or a piece of paper. The plastic and dural dispenser shown here keeps a roll of 500 stamps in sight on your desk top and also serves as an ornamental paperweight. All the dimensions are given in the drawing at the right. I cut the body from dural tubing, slotted it with a saw, and cemented it to the base. However, the body could be cut from a plastic cylinder. The top is rabbeted to fit inside the body, or it may be made by cementing together two disks of different diameters. The decorative knob shown in the drawing is optional.—*Joseph F. Gréce, Manhattan, N. Y.*



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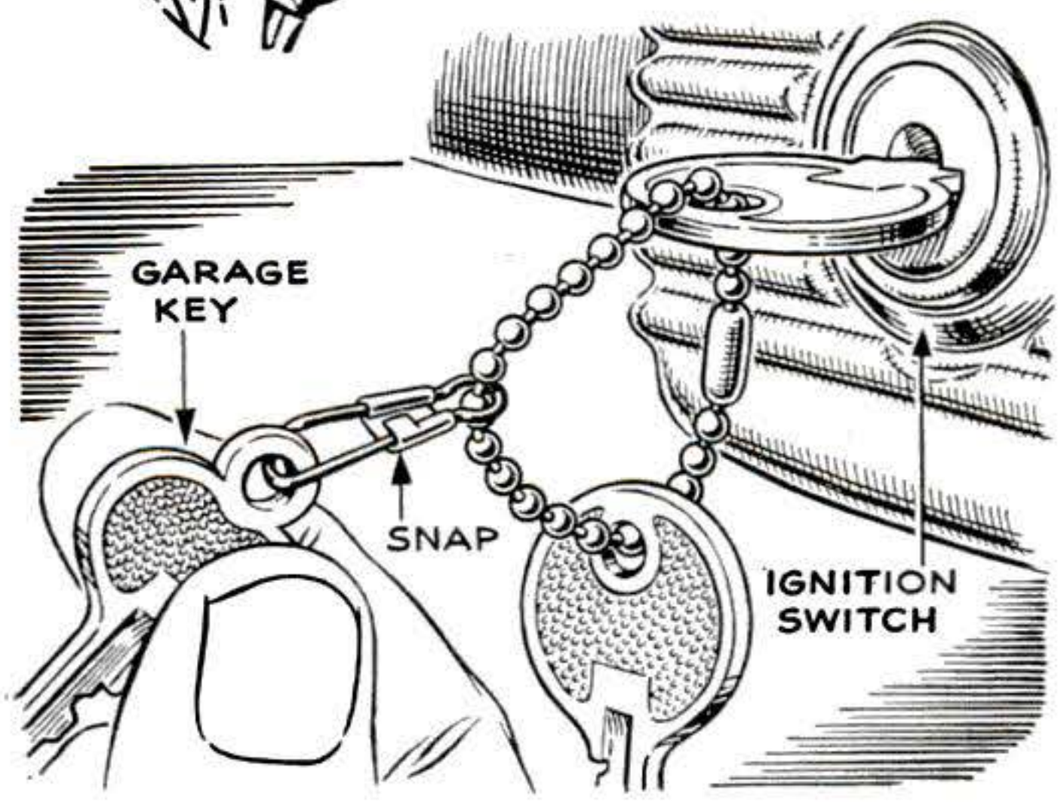
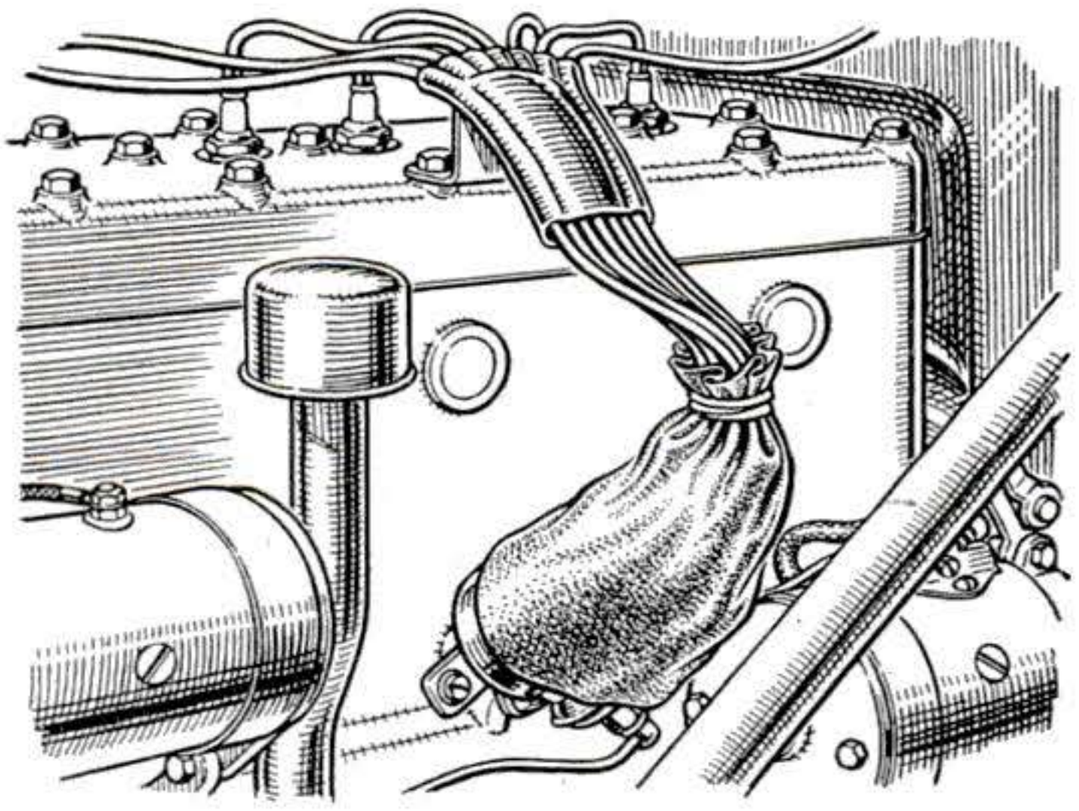
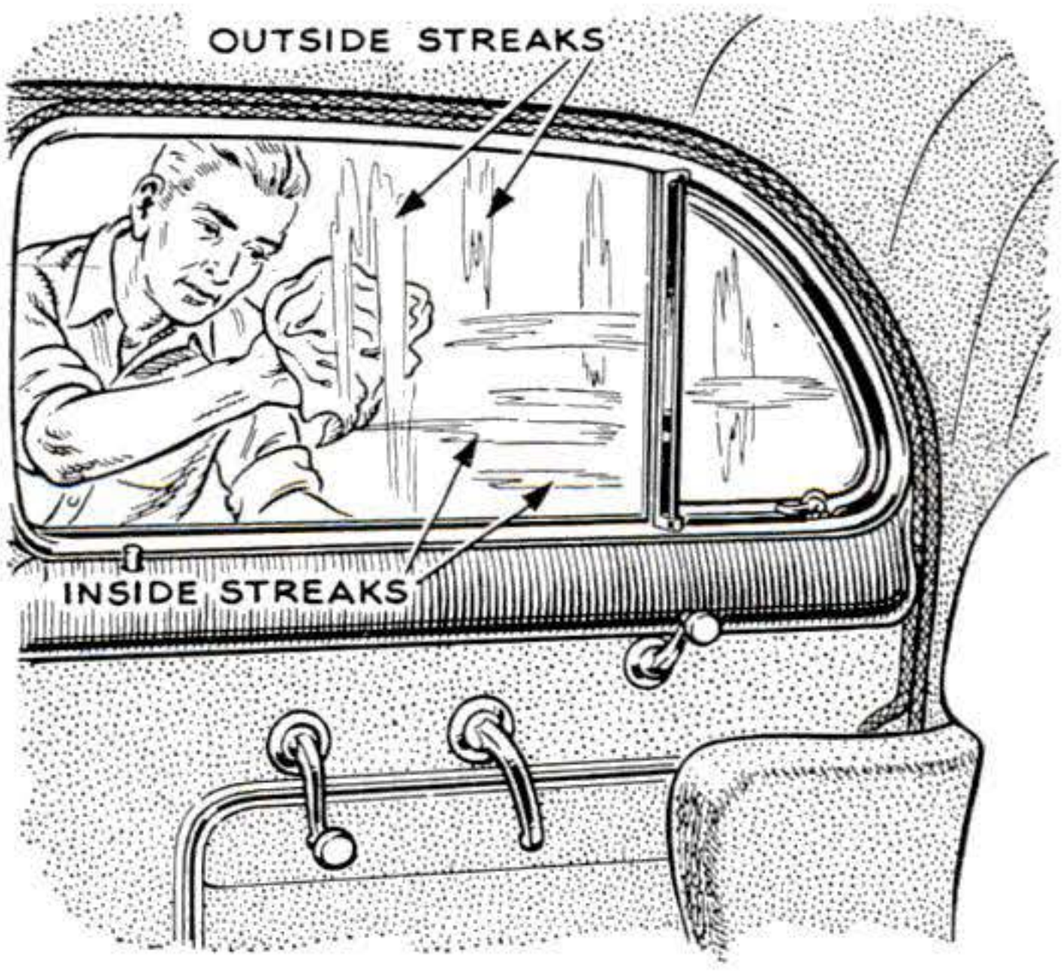
Hints from the Model Garage



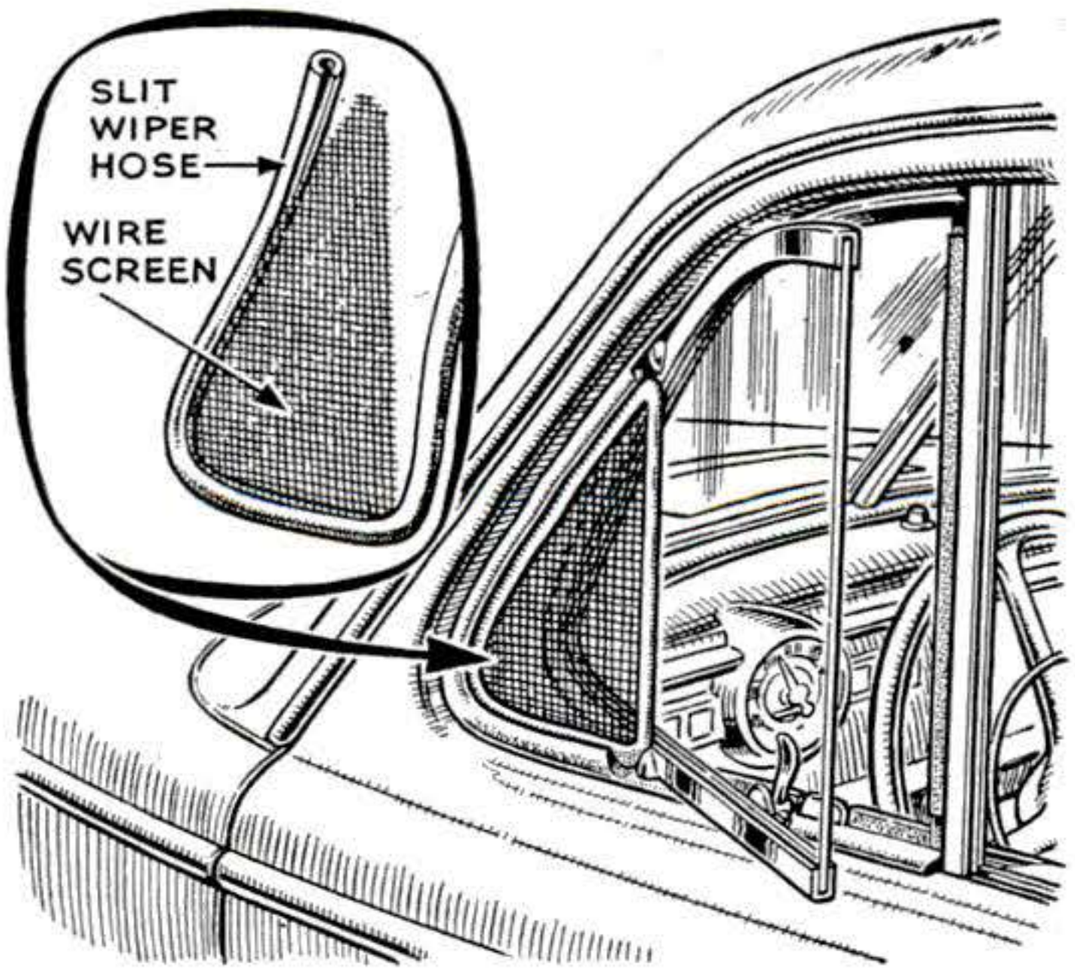
Garage Key Slips off Ring. It's always a nuisance if you must turn off the ignition and carry along all your keys when you unlock the garage door. This can be avoided if you have a quick, easy way to remove the garage key from the ring. Here's one possible way. The fishing-tackle snap shown can be bought in most tackle shops.



Sleeve Protects Ignition. If you have had trouble with the ignition shorting out during heavy rain, here's an idea that may help you. Cut an 8″ section from an old inner tube, snap loose the distributor cap, slip the rubber sleeve over the high-tension wires, and replace the cap. Draw together and tie the sleeve at the topmost edge.



Get Off All the Streaks. Did you ever wash a car window and find when you're through that it's still streaked? H. R. Schaaf, of Louisville, Ky., says he has found it's best to use horizontal strokes of the cleaning cloth on one side of the glass and vertical strokes on the other. Then, if there are any streaks, you know at once which side they are on.



Screen Catches the Bugs. For summer driving, a triangular piece of screening fitted into the area in front of the vent pane will catch any insects that are drawn in with the air. You can solder a heavy wire around the screening or just slip on slit wiper tubing as in the sketch. It's only a moment's work to slip out the screen and close the ventilator.

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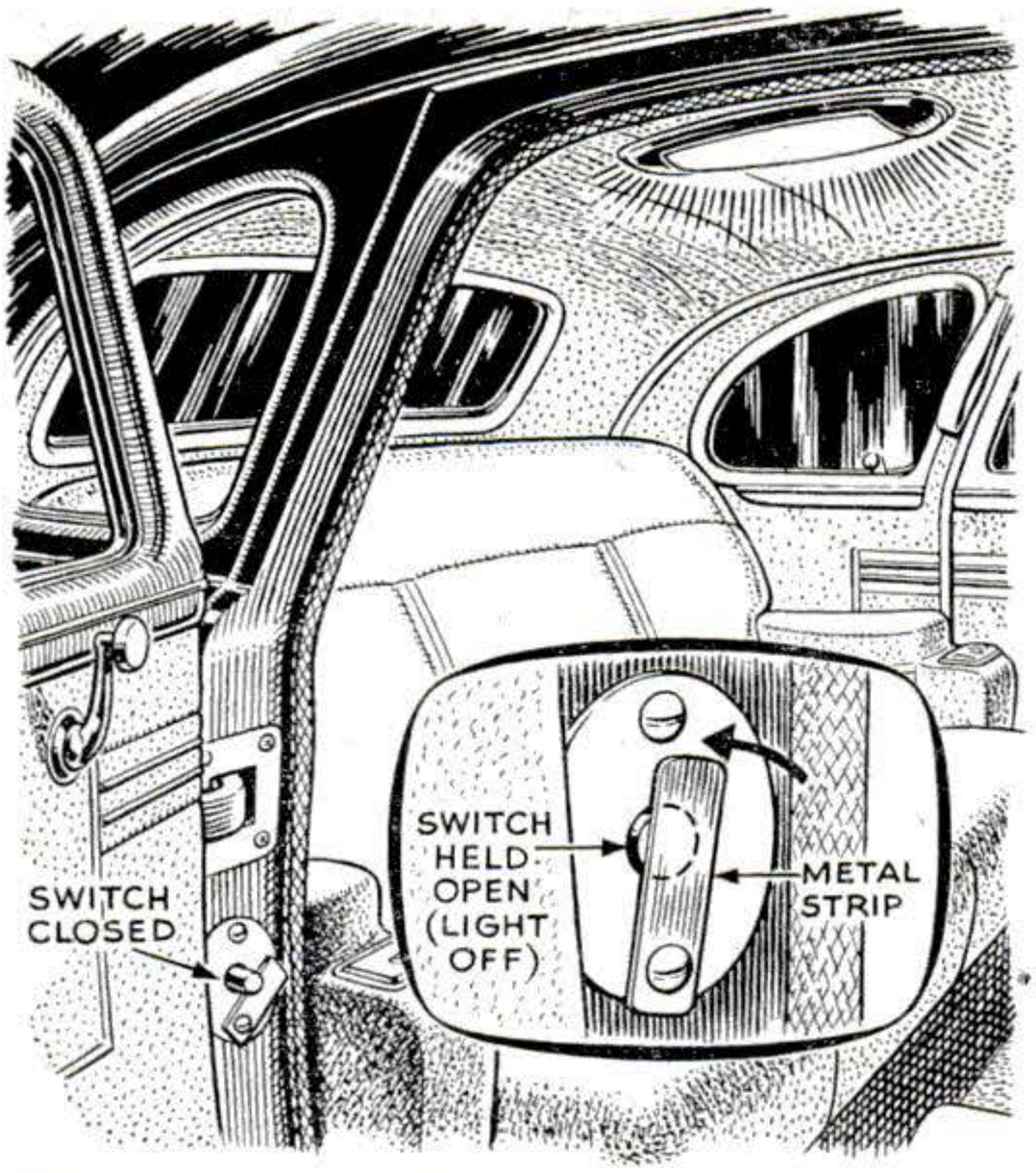
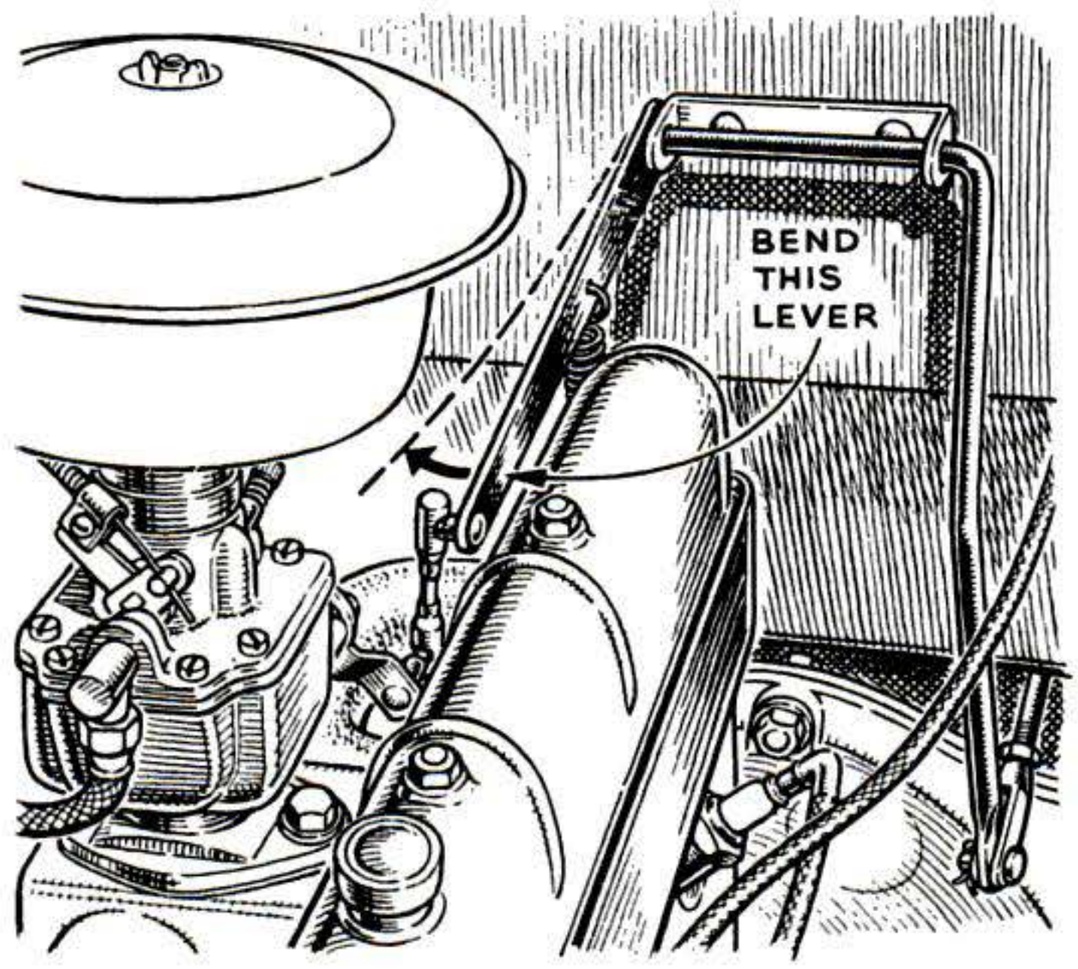
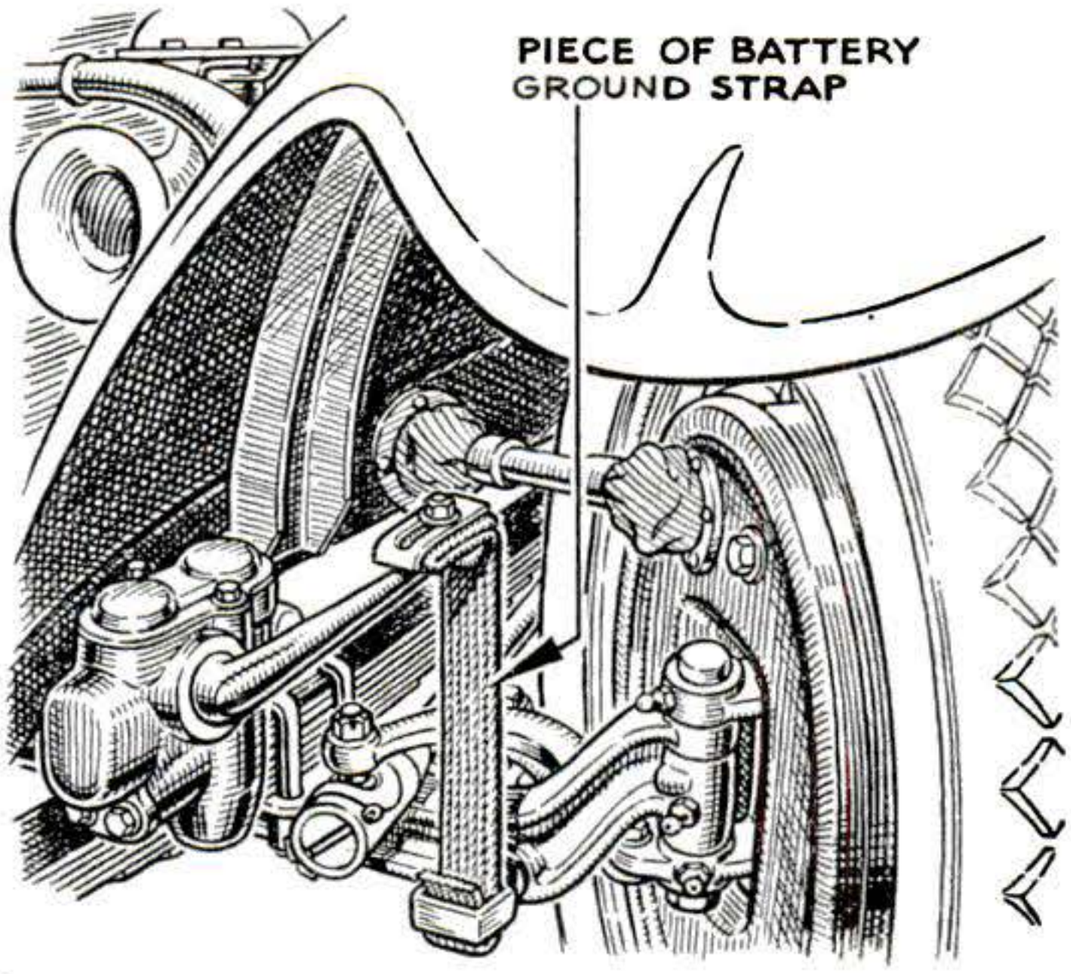


Door Open, Light Off. Door-operated dome lights can't ordinarily be shut off if you just want to park with the door open. Wesley E. Charter, of Rockville, Conn., suggests that this can be done with a strip pivoted on one switch screw, preferably the lower one. It takes only a moment then to pivot the strip over the switch button.

Mirror Is Always Handy. Here's the way W. M. Dierks, of Chicago, filled the bill when his wife asked for a convenient mirror for use in the car. Buying a large compact, he mounted it as shown inside the glove-compartment door, drilling holes and attaching it with screws. While not in use, the compact is kept closed.



It Wasn't a Ghost. On right turns, Eric St. Clair, Richmond, Va., found his Crosley accelerating of its own accord. He traced the cause to contact between the throttle linkage and camshaft cover. Bending the link cured the trouble. His explanation: On right turns the engine mounting was flexible enough to let the camshaft cover bear against the linkage.



Strap Repairs Shock Absorber. This is how E. V. Collins, of Bantam, Conn., repaired an old-type shock absorber when the web strap broke. Unable to buy a new one, he tried woven brake lining but it soon broke. Then he used woven copper braid made for ground straps on batteries, installing it as shown in the sketch. It's given good service ever since.

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There's Magic in Chemistry

CHEMISTRY is usually a serious business, but it can also be a means of entertaining your friends. With a few common chemicals you can perform a number of apparent feats of magic. The ordinary magician must depend on sleight-of-hand to get his effects, but that's not true with chemical magic. There are no tricks involved. You just take advantage of natural laws. Here are a few of the chemical feats you can perform.

Clear Solution Turns Blue. Dissolve ½ gram sodium or potassium iodate in a little water and add more water to make 225 ml. Set this solution aside. Then make a starch suspension by mixing 2 grams starch with 100 ml. water and bringing to a boil. After filtering, add this to a solution of .2 gram sodium sulphite in 50 ml. water to which you've added 1 ml. dilute sulphuric acid (1 part concentrated acid to 50 parts water). Add water to second solution until you have 225 ml. Allow to cool.

Put some of the first solution in a beaker and add an equal amount of the second while stirring. Then stand aside, make a few passes with your hands (at the time you've determined by experiment beforehand), and the clear solution will instantly turn to ink. Iodine, set free, reacts with the starch, forming the blue coloration.

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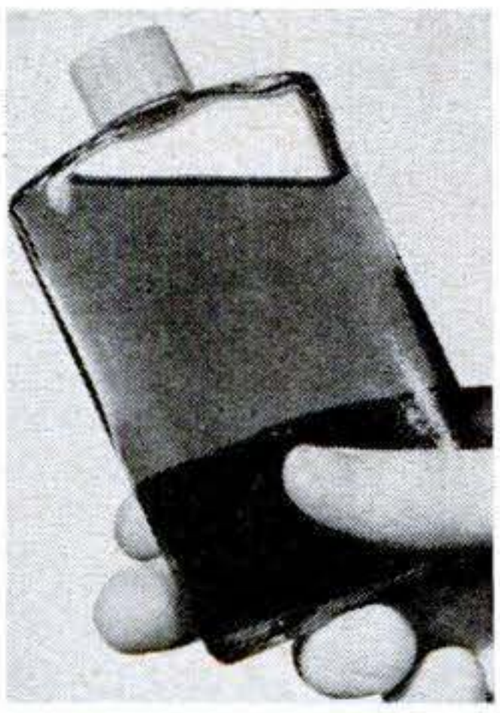
Write in Color. Here's a case where you write on white paper with a finger moistened in water—and each line comes out a different color.

Prepare a sheet of coarse-grained white paper beforehand. Into the top third rub a dry mixture of equal parts tannic acid and ferric ammonium sulphate. In the middle area repeat with a similar mixture of sodium salicylate and ferric ammonium sulphate. Treat the lower third with sodium ferrocyanide and ferric ammonium sulphate.

It Grows Whiskers. If you write on aluminum foil with a glass rod dipped into a water-clear solution, white whiskers will sprout from the letters.

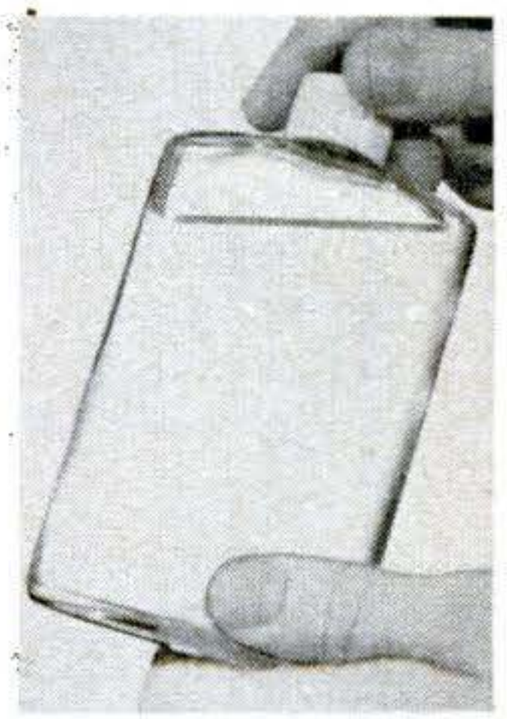
Be sure the foil is free of grease. Do the writing with a saturated solution of mercuric chloride. In a few seconds, blot off any excess with a paper towel. The mercury amalgamates with the aluminum and the latter reacts with oxygen in the air, producing the fuzz. This solution is very poisonous, so wash your hands thoroughly.

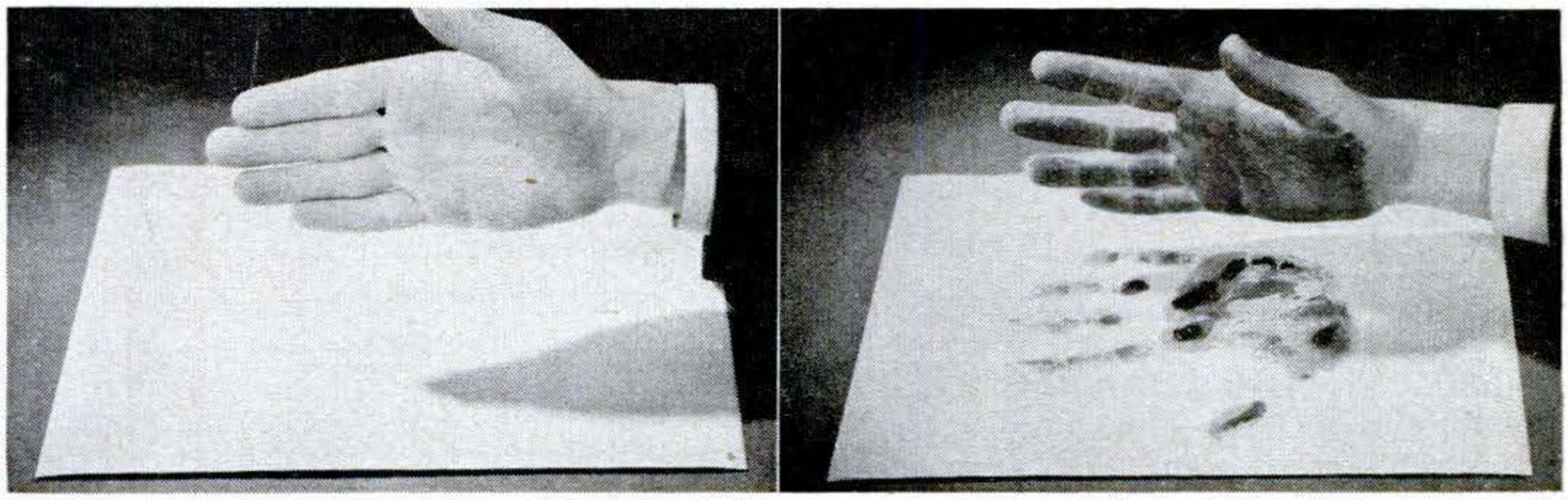


Dark Solution Clears. You can turn what seems to be root beer to a water-like liquid without opening the bottle

Make the "beverage" by adding tincture of iodine to water. If the bottle has a cork, press a few crystals of photographic "hypo" (sodium thiosulphate) into a hole cut in the inside end. If it has a screw cap, attach the crystals with glue.

To work your "magic," merely shake the bottle a few times. As soon as the hypo dissolves, the liquid becomes colorless.





Clean Hand Leaves Mark. In this puzzling trick, a clean hand is pressed on a sheet of white paper. When the hand is removed, a print remains on the paper.

Get ready by rubbing powdered tannic acid into coarse-grained paper. Just before performing, secretly moisten the palm of your hand on a cloth wet with ferric chloride solution. When in contact, the two chemicals form a black compound.

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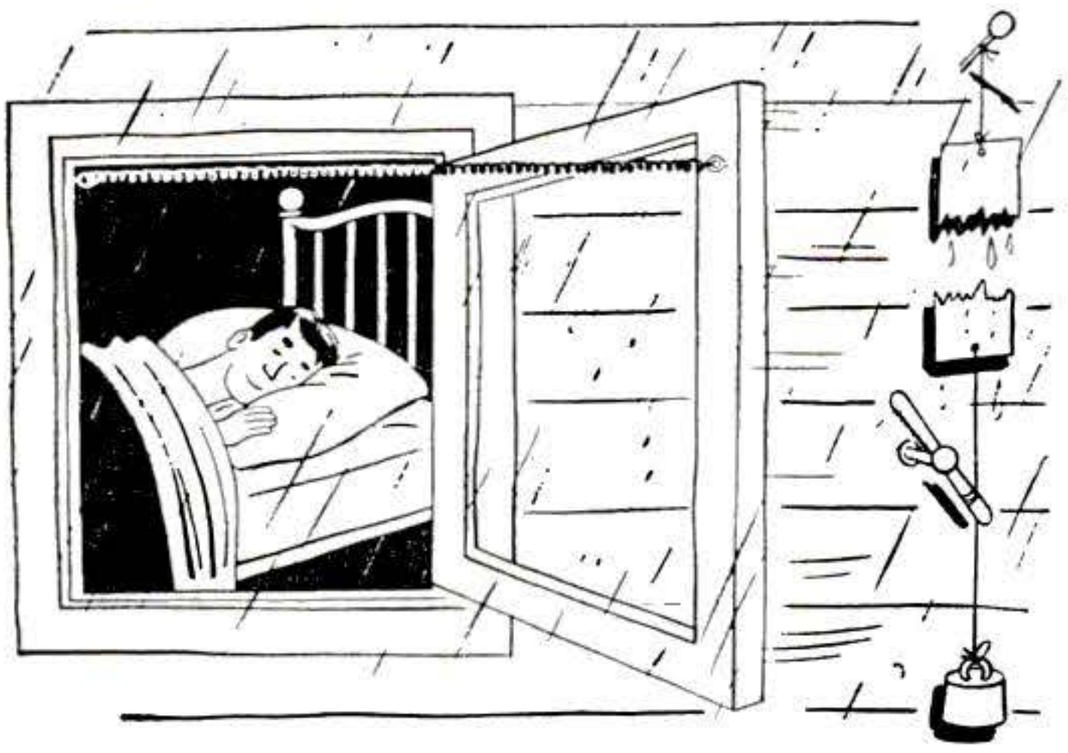
What's Your Ingenuity Quotient?

Rocks in my head was what a friend thought I had when he saw me putting rocks in a canoe. I'd salvaged a badly damaged canoe, and to re-cover it, I ran wire hooks through the edges of the canvas and nailed the other ends of the hooks to ceiling beams. Then I wet the canvas and placed the canoe in it. The rocks were for additional weight to stretch the canvas tight. *—F. G. Semple, Ottawa, Ont.*



I have nothing against water, if it stays in its place, but I don't like rain blowing in on me while I'm trying to sleep. So I hooked up a weight and a piece of blotting paper that releases my window catch when it rains. A spring pulls the window closed. Water causes the blotter to tear and the weight pulls the catch down. *—W. M. G. Fernando, Colombo, India.*

We've got so many cats that I found myself working overtime opening the door for them to trot in and out. But not any more. With a few scrap boards about 3′ long, I built a tunnel to fit over an 8″ by 10″ hole that I sawed in the cellar door. The tunnel keeps rain and snow out, but the kitties can parade in and out any time.—*Orville Grisier, Denver, Colo.*

Replacing one of our high-ceilinged light bulbs used to be a big production—lugging a stepladder from the garage, setting it up, putting in the new bulb, and lugging the ladder back to the garage. But now I let my tank-type vacuum cleaner do the job. With the dusting attachment on the end of the metal extension tubes, the suction holds the bulb while it's screwed in the socket.—*Mrs. Hal Geihm, Aurora, Ill.*

Have you pulled off a smart one lately? We will pay for acceptable contributions showing ingenious solutions of problems in the home, shop, garage, or camp. It doesn't matter if it's wacky—if it works. Use government postcards only. Contributions cannot be acknowledged or returned.

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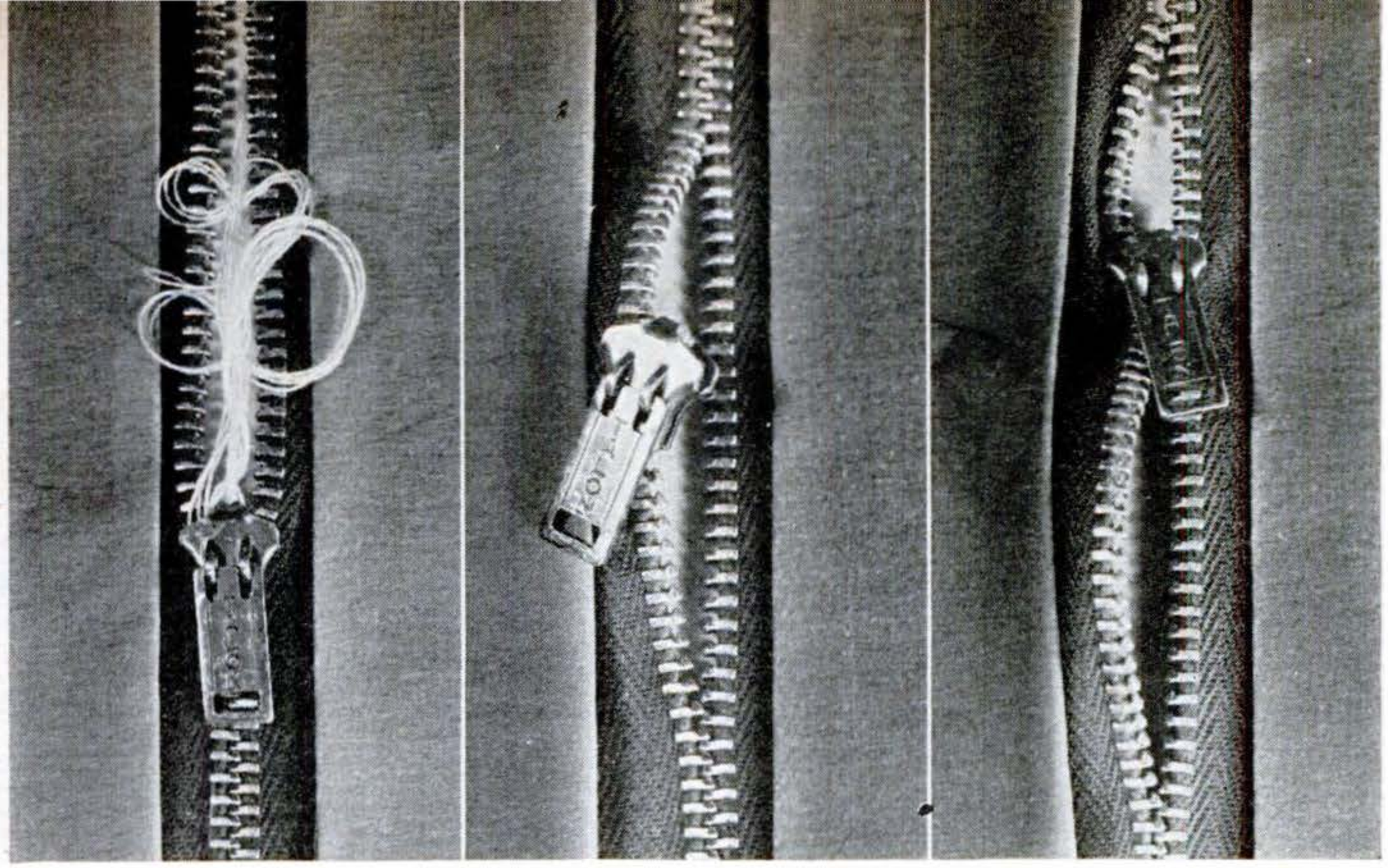


Zipper trouble usually occurs in one of three forms. You can make a repair in each case.

What to Do When Zippers Won't Zip

FIXING a slide fastener is not always as simple as sewing on a button, but it usually can be done. The job pays, too. You often can salvage an item that has been cast aside as useless.

There are some cases, however, where you may just as well give up any thought of repair, rip out the old tape, and install a new fastener. For instance, you can't do much with a plastic zipper or one that has lost any teeth.

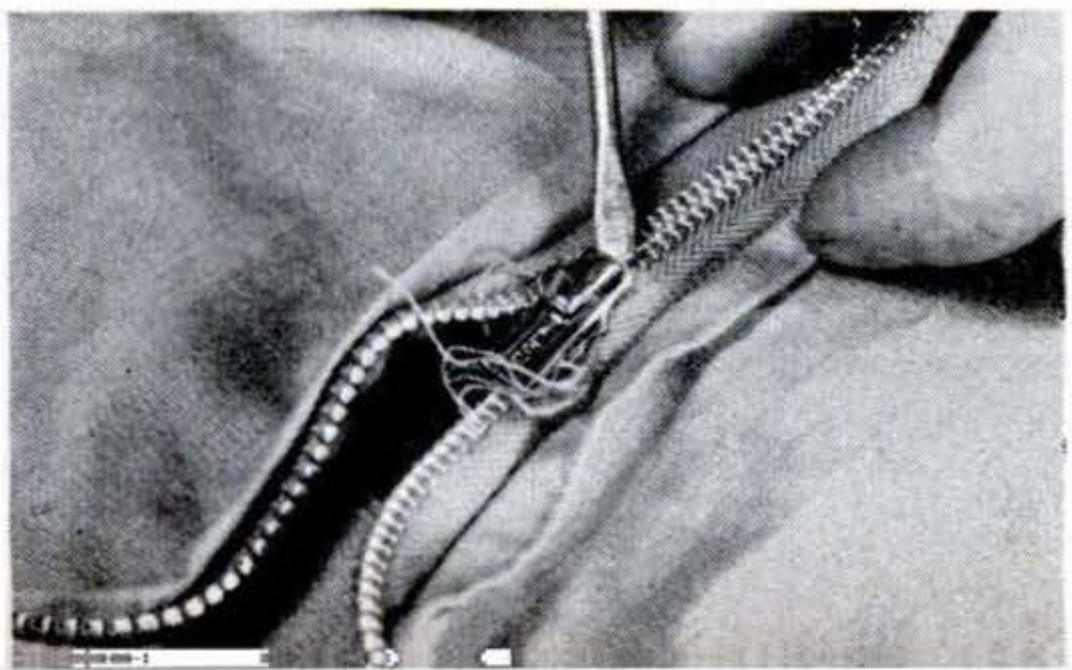
But beyond this, you have a big field of possible repair operations. If thread or other material has jammed the slide, you may be able to cut and pull it out. If not, pry the jaws of the slide apart until it can be moved.

Prying the jaws apart means that they will be out of line, so you have to realign them. In fact, a deformed slide is the major cause of zipper disorders. Unless the jaws are strictly parallel, the slide may jam, come off one row of teeth, or fail to draw the teeth together into locking position—as seen above.

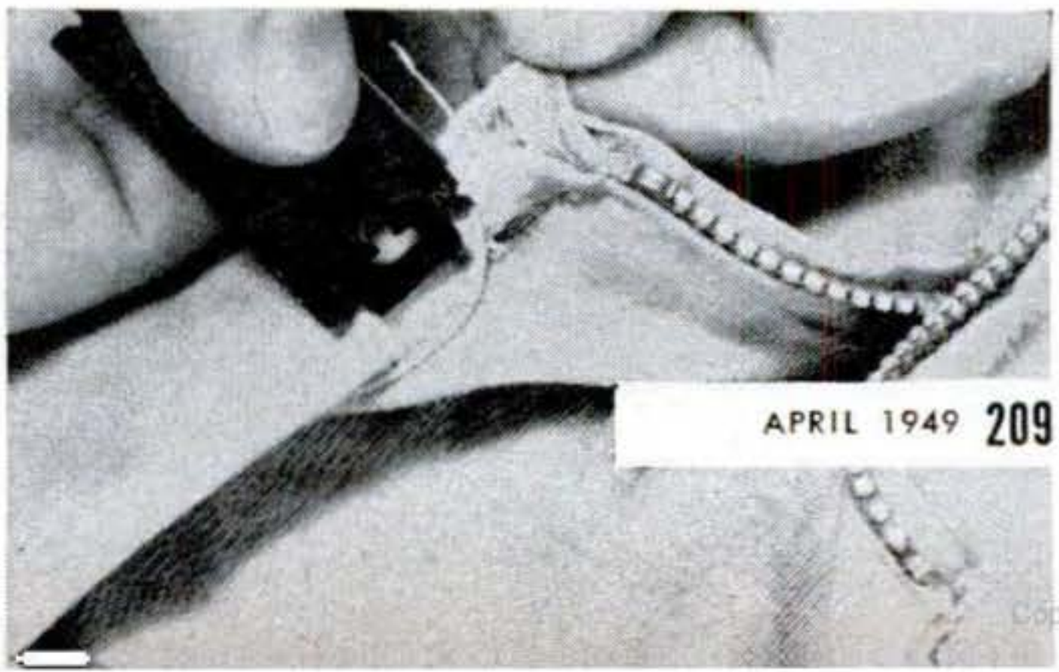
In such cases, it's advisable to remove the slide so that you can compress or pry apart the jaws to make them parallel, as shown in the drawing on the next page. After the slide has been straightened, you face the job of locking the teeth together before replacing the slide. This can be done by hand, but it calls for lots of patience.

Start at the bottom. holding just the ends of the rows between thumbs and forefingers. Roll the teeth together so they mesh much like gears, remembering that you can engage only one pair at a time. When you move up to a new grip, keep a tight hold on the

Slide must be removed for most repairs. To do this, begin by prying apart the jaws at the open end of slide, using a small screwdriver.



Next cut loose the ends of the fastener tape with a razor blade. Cut only a few stitches, just enough to free the end of tape.



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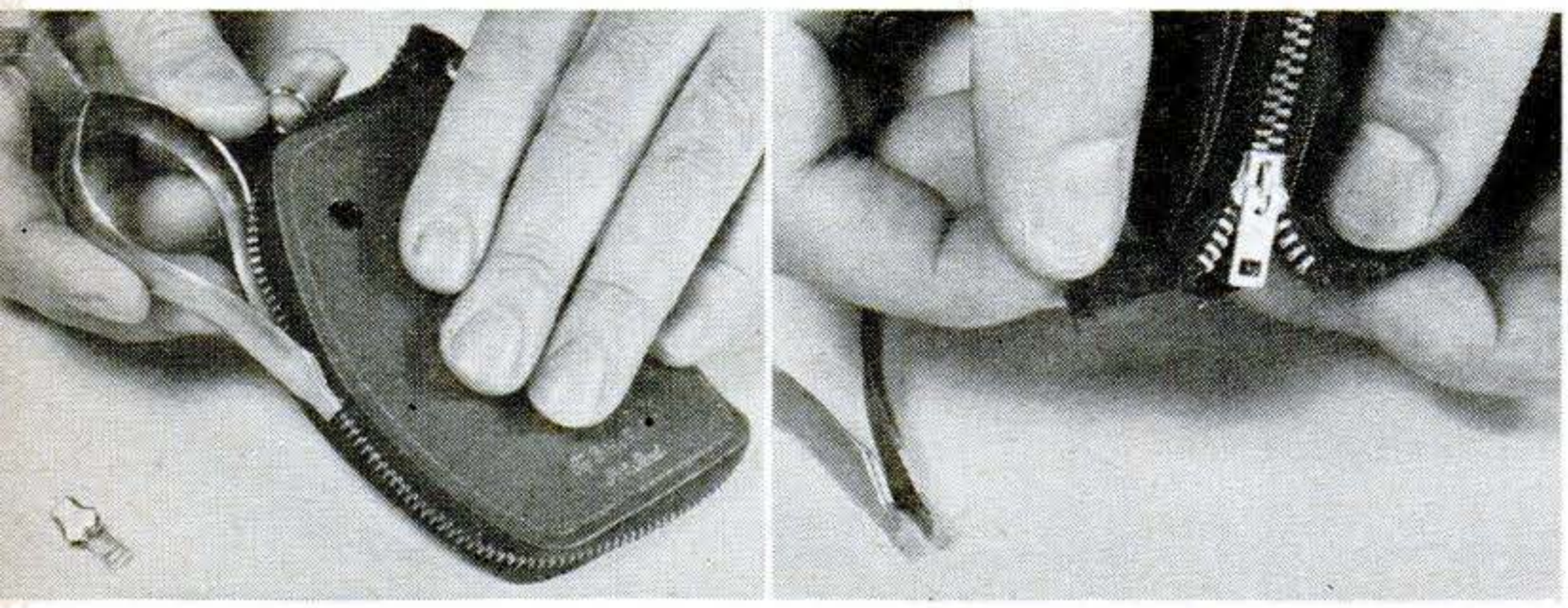
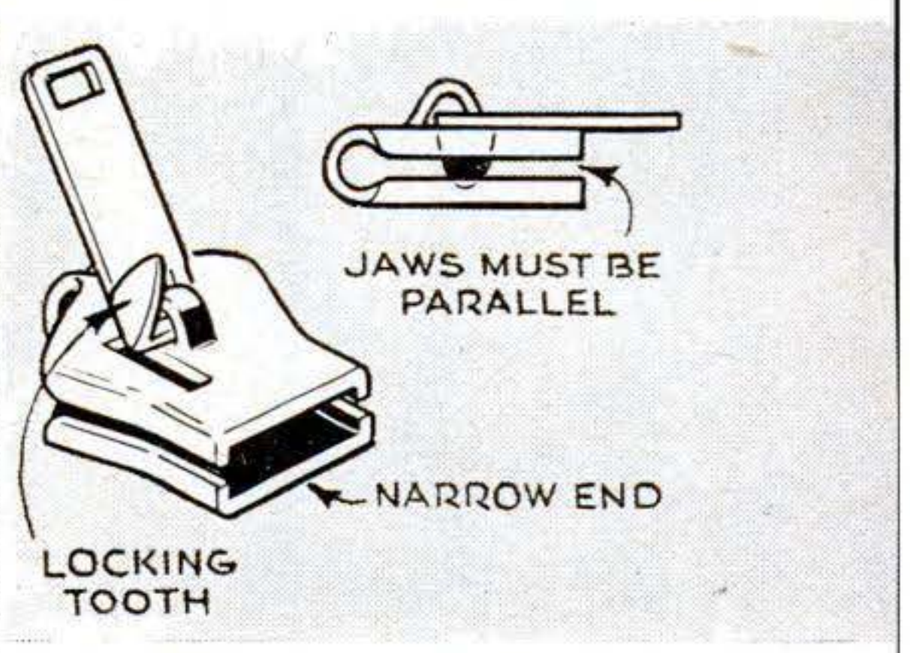
Pry off the zipper stops. These are usually clamped to the tape rim. You can now remove the slide (center) and bend the jaws true. If the fastener is the separating type that opens at the bottom (above right), the slide is simply slid back on the row of teeth with the large bottom stop. On nonseparating zippers, teeth must be closed to get slide on from top end.





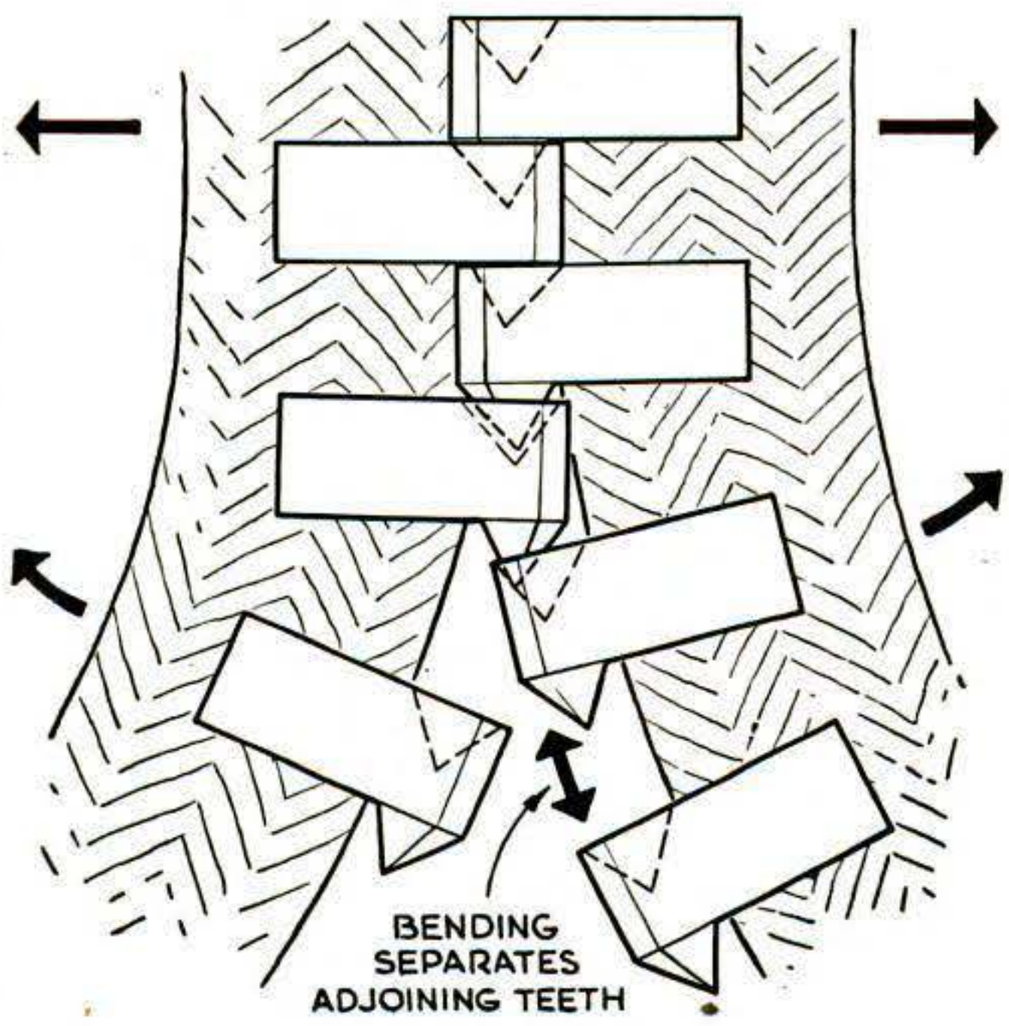
Special tool was recently introduced by More-help Products, Lakewood, N. J., to aid in zipper repair. As seen above, it pulls the two rows of teeth together. The repaired slide can then be replaced (center). When you make any repairs to a zipper, the jaws of the slide must be exactly parallel. If they're not, pry them apart or pinch together as required.

last teeth closed, or you'll find yourself doing the whole chore anew.

A special tool, shown in use above, will enable you to do this job in a jiffy. With it, you can lock the teeth just as you would with the slide itself.

When all teeth are closed, push the slide on the two rows at the end where you've ripped the tape loose. Once the zipper is working properly, replace the original stops. If this proves too difficult, stitch in thread stops.—*Arthur C. Miller, Manhattan, N. Y.*

Gear-Tooth Meshing Is Secret of Zipper Action



Look closely and you'll find that each tooth of a slide fastener has a dimple on one side, a hook on the other. It's plain that one fits inside the other to close the magic seam that stands cross pull, yet unzips at a touch.

But how? Take one row of teeth in your fingers and bend it into a flat loop, teeth out. See how the points of the teeth get farther apart at the curve? That's the secret.

The slide is so shaped that it feeds the two rows of teeth into each other, holding opposite teeth as if the entire row were curved. This lets one hook and one socket engage at a time.

Once engaged, they resist a strong crosswise pull. But unhook the first two teeth, bend the tape, and the teeth come loose one after another.

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Hand Tools Build Modern Table

By Leopold Newman

Author of "Woodworking Made Easy"

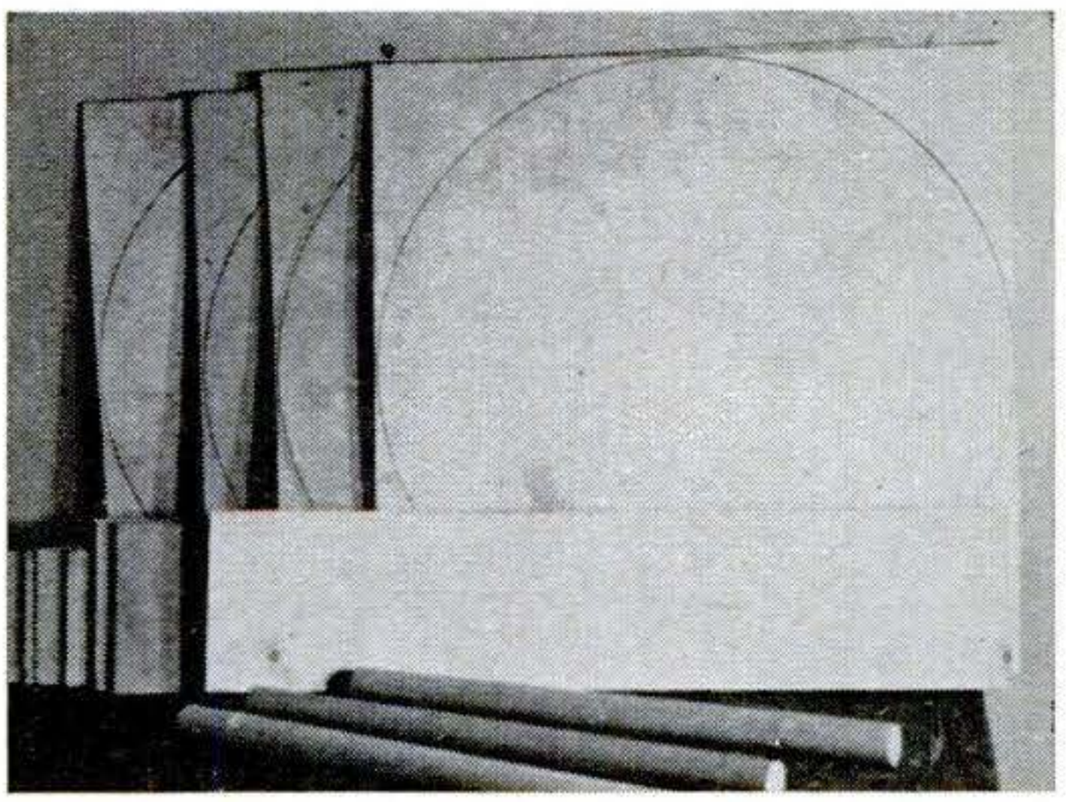
Modern coffee table built with hand tools and $8 worth of materials. Top and shelf are four pieces of 5/32" plywood shaped without a saw. Lines were scored and pieces snapped off.

UNLIKE the old saw about a square peg in a round hole, this table was built by putting round holes in square panels—but without a saw.

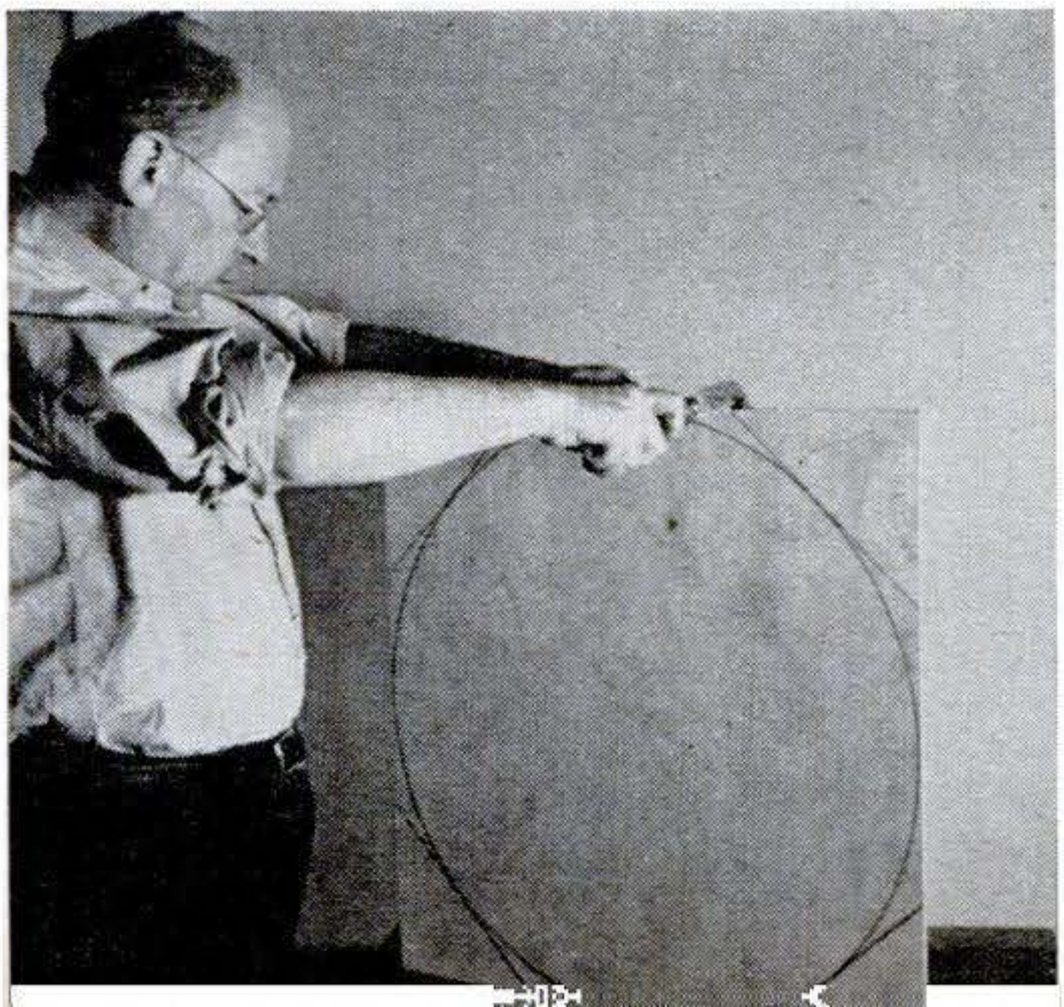
That's the most unusual feature of this double-decked coffee table—the four circular pieces that make up the top and shelf. They were made without use of a saw. Using 5/32" plywood, I scored tangents to the circles and snapped off the pieces. I continued scoring and snapping until I had a rough circle. Then I sanded it smooth and round. Of course if you have a coping saw, you can put it to good use.

The materials cost about $8. Here's what you'll need: four 25" squares of 5/32" birch plywood; three 1⅜" by 21" dowels for legs; a few long 1¼" strips of the plywood; some narrow 1¼" stock for spacers; and some finishing nails and glue.

On two of the plywood squares, draw



Here are the principal parts: four 25" square panels of birch plywood and three 1⅜" by 21" dowels for the legs. Strips of the smaller plywood pieces formed rims around top and shelf.



1. After scribing circles on each of the four squares, draw tangents. Mark across the ends of the tangents with a linoleum knife to locate them on the other side.

2. Draw identical tangents on both sides of the panels. With a straightedge as a guide, score the lines three or four times on each side and break off the triangles.

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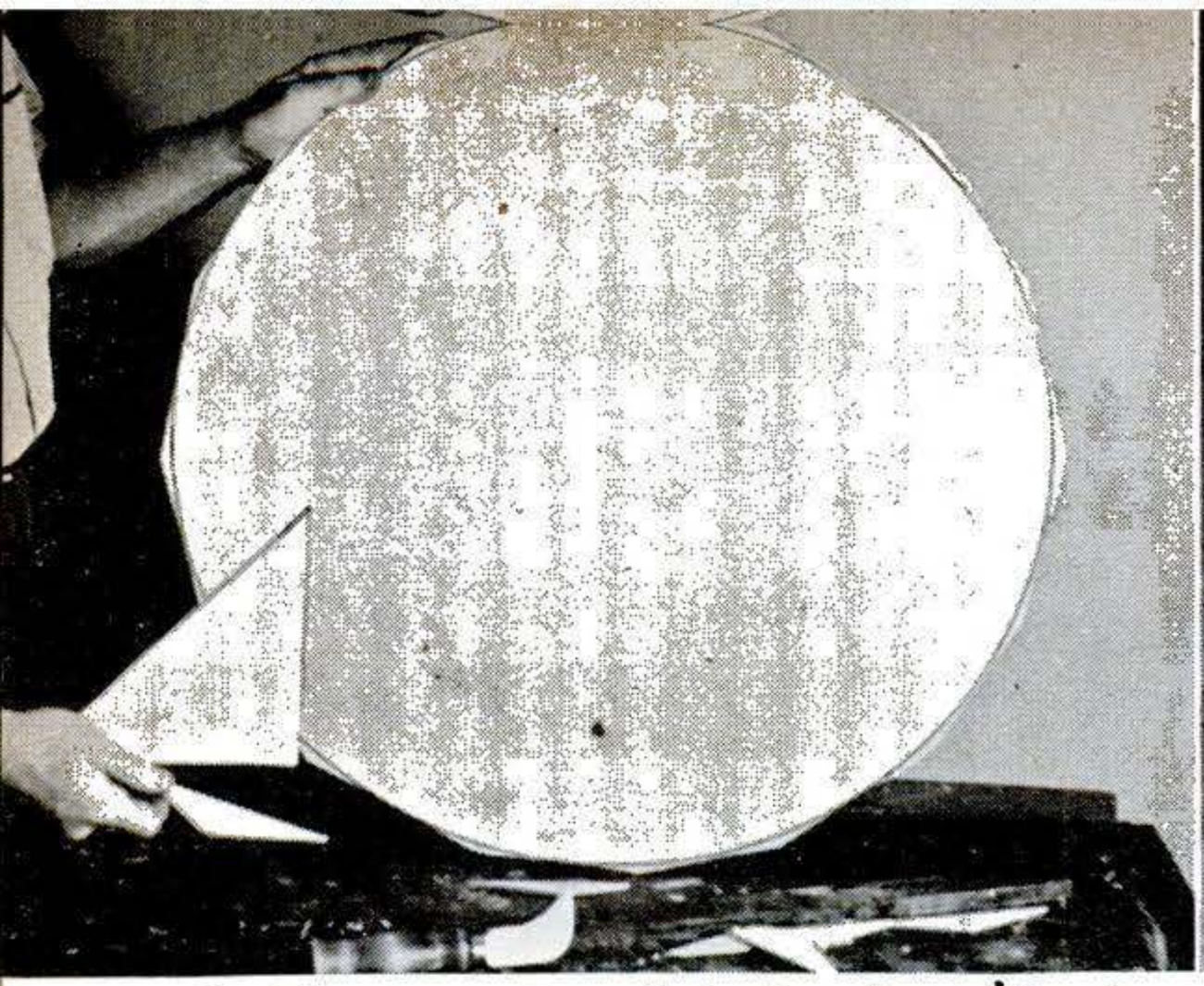
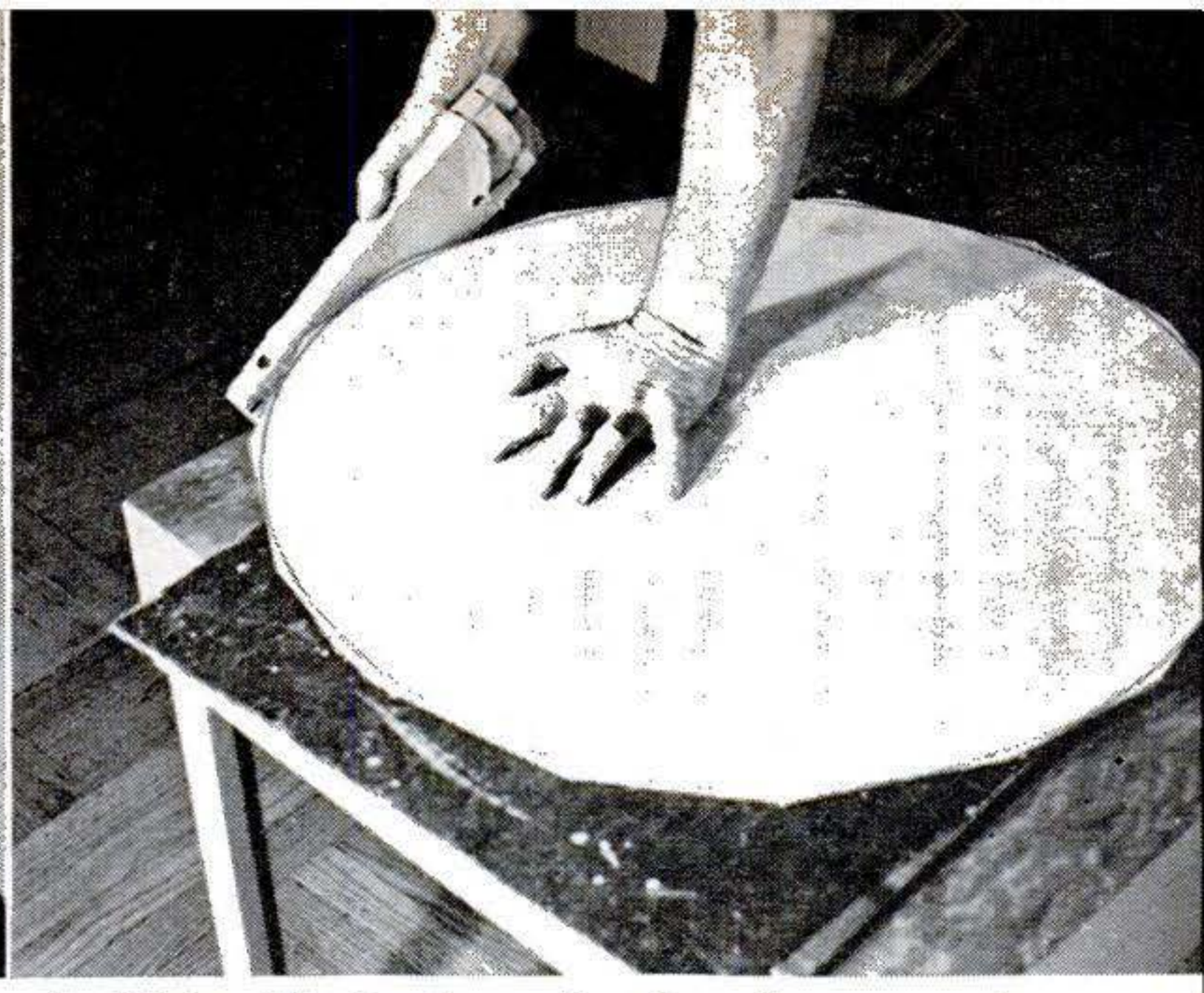
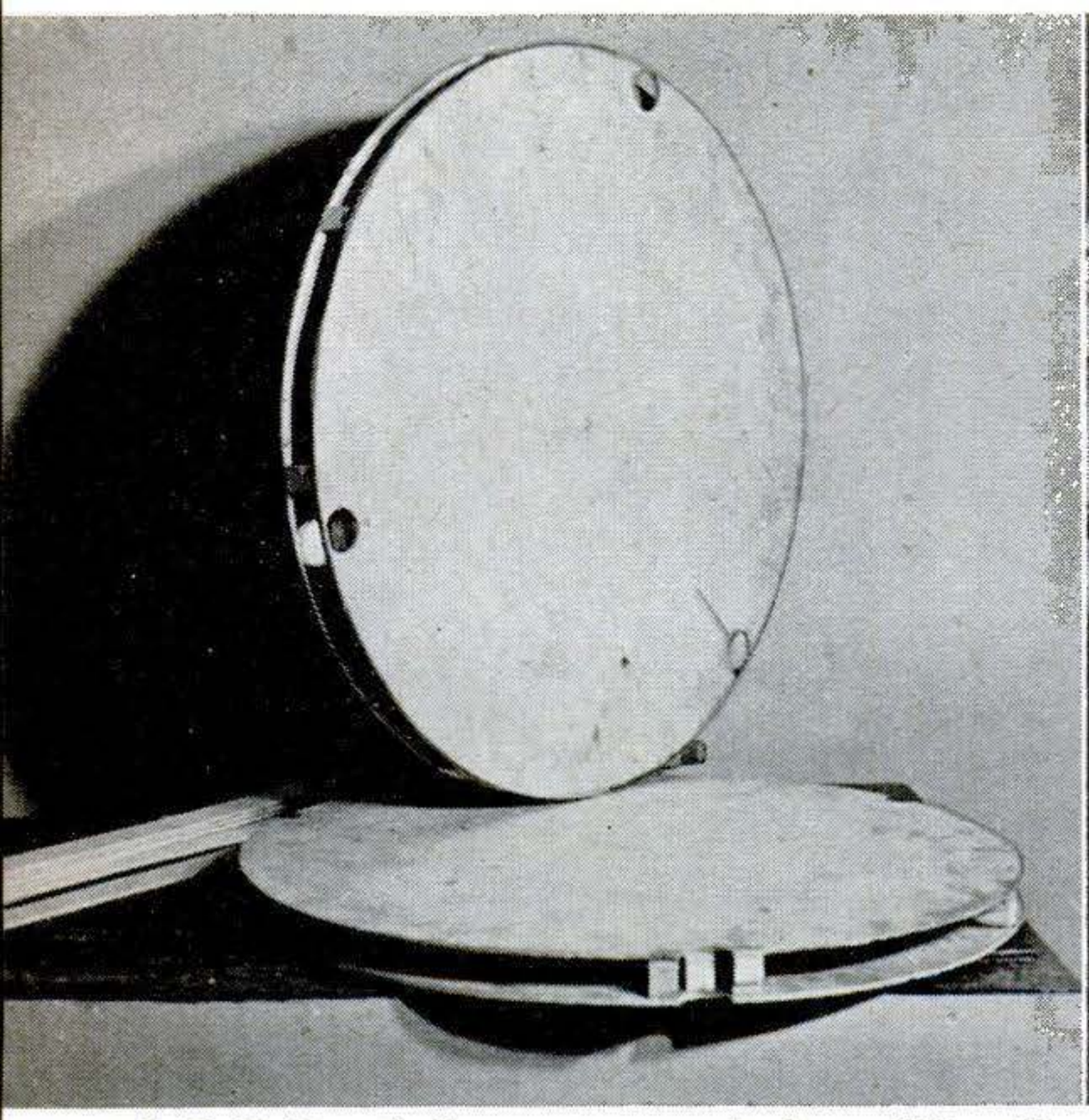


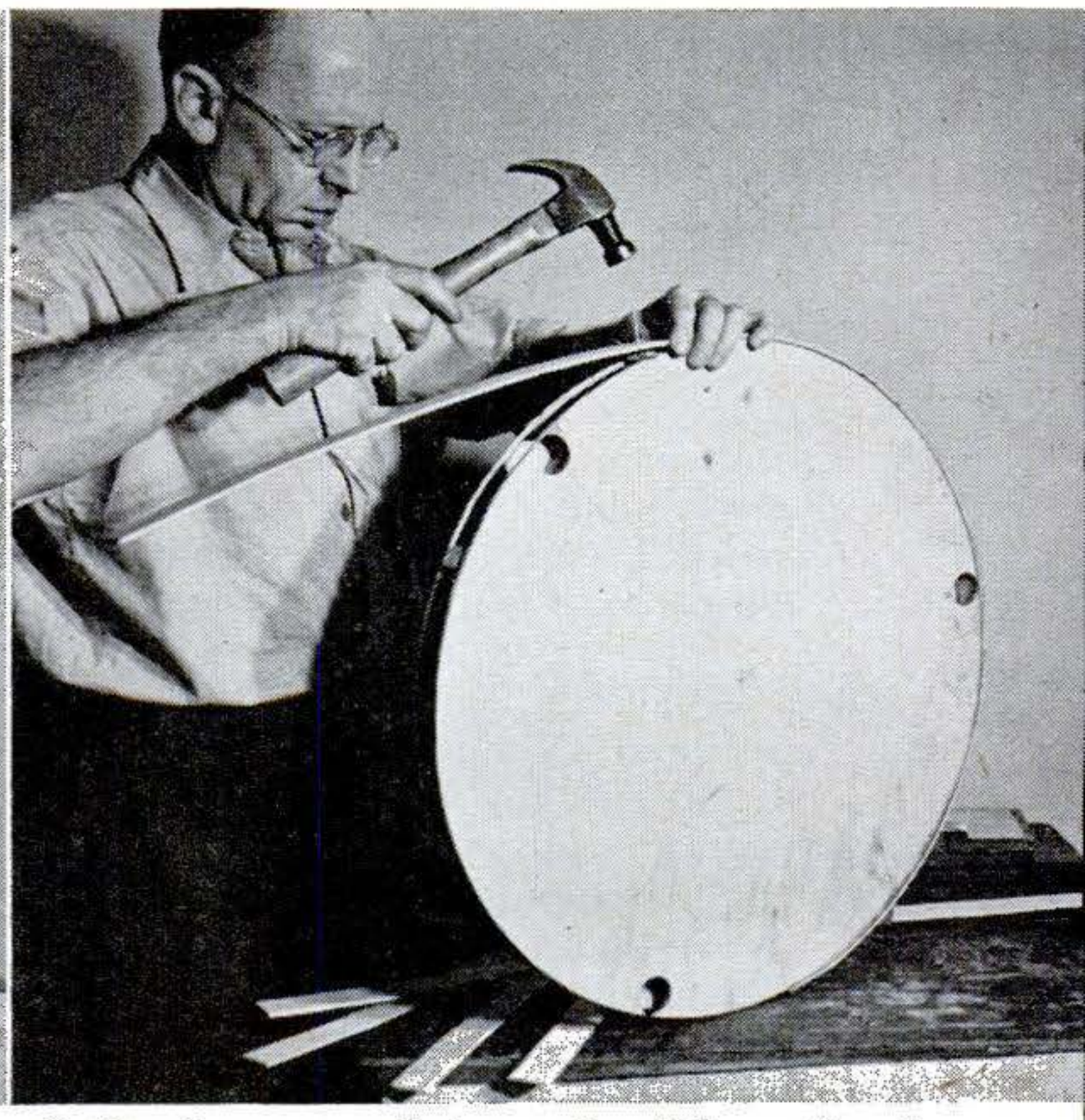
3. After snapping off the four large triangles, draw more tangents, score them, and break off the waste. Continue until you have a rough circle. Always score the tangents on both sides.



4. With a block of wood and sandpaper, work around the rim of each plywood disk until you have a circle. Two disks are 25″ in diameter and the other two are 24 5/16″ in diameter



7. Nail and glue spacers to the large disk with holes in it and to one of the shelf disks. Fasten other disks to spacers. Make certain that the cutouts in the shelf disks register.



8. To close space between the disks, nail and glue long strips of 5/32″ plywood to spacers. These strips must be cut so that the grain on the outer plies runs the short way.

circles of 12½″ radius. On the other two squares lay out circles of 12 5/32″ radius. Then draw tangents to the circles. These tangents must be drawn in identical positions on both sides of each square. Then with a steel rule as a guide, score the tangents on both sides. Make three or four cuts along each line. The triangles left by the scoring will break off easily. Continue scoring and breaking until you have a rough circle. Sand it smooth and round.

Center the two small disks on one of the large disks. On the edge of a small disk lay out three marks spaced 120 deg. apart. On each mark center a 1⅜″ bit, spotting it so that in the smaller disks, the bit will make a semicircular cutout. In the large disk, the bit will make a hole close to the edge. Bore a hole at each mark, taking pains not to tear the edges.

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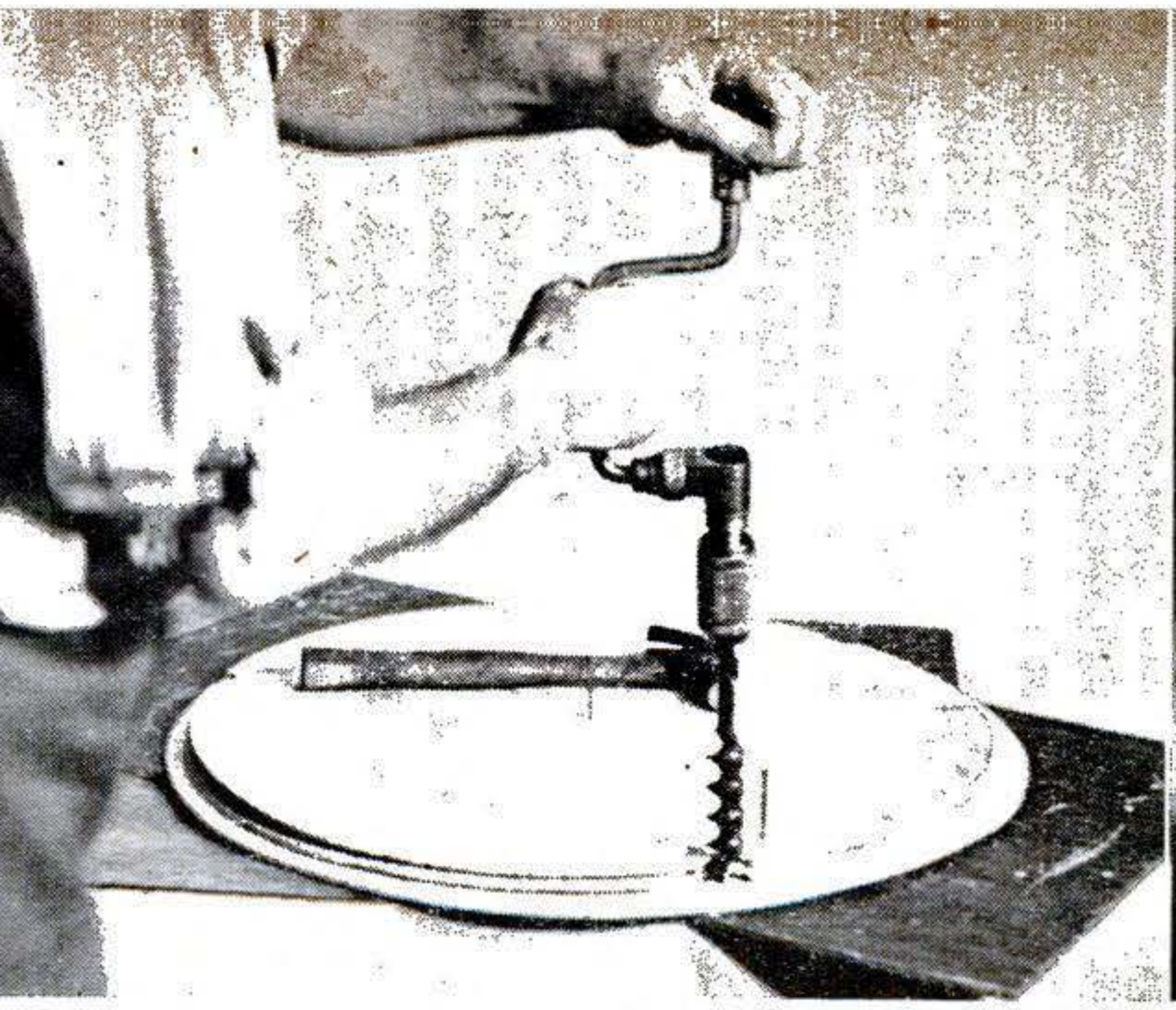
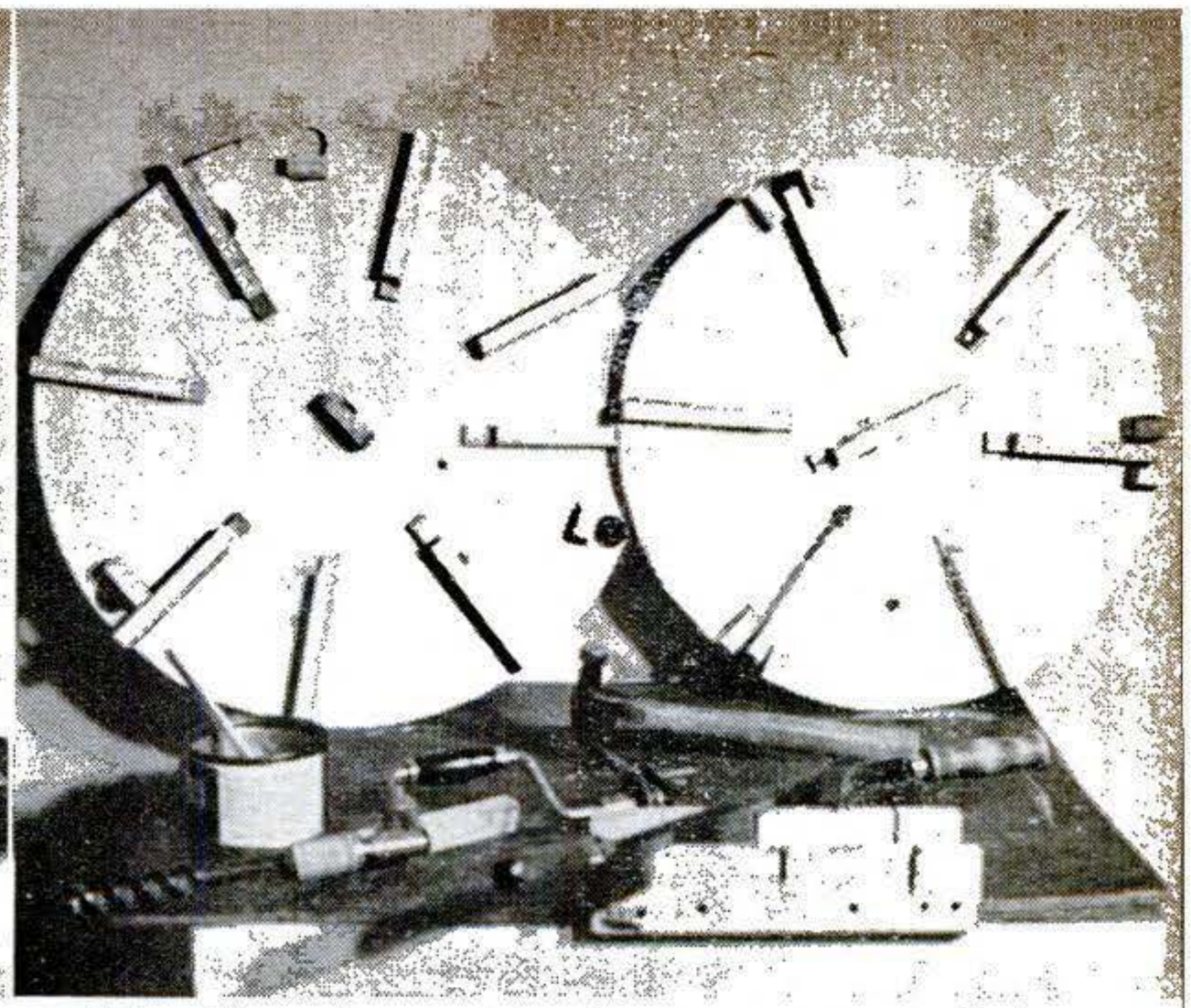
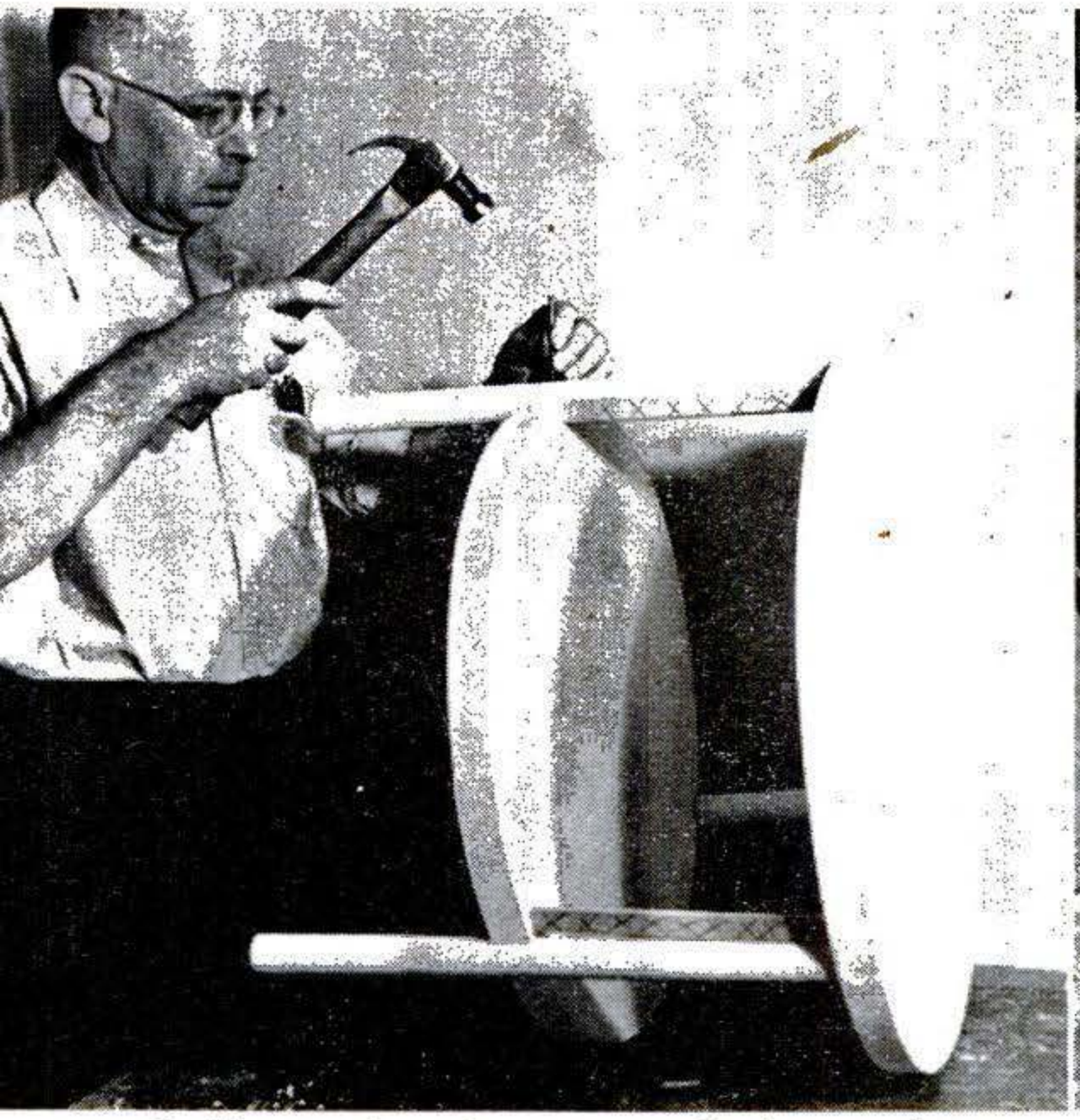


5. Center the small disks and one large disk with a nail. Hold them with another nail. Drill three evenly spaced 1⅜" holes, centering the bit on the edge of a small disk.



6. Bit will make semicircular cutouts in small disks and holes in large disk. Spacers shown here were built up of scrap to total exactly 1", but 1¼" stock could be used.



9. Glue and nail, or screw, the legs to the top and shelf. Use three 10" spacers to position the shelf accurately. Sink all nailheads, fill the holes, and sand the table smooth.

10. The table pictured above was finished with enamel. Then a fabric cover to match the drapes was put on the top and a piece of plate glass used to protect the fabric.

Next cut up the 1¼" stock into 11 pieces 2" long and 14 pieces 6" long. Nail and glue eight 6" spacers to a large disk—the one with the holes. Space them equally and with the ends flush with the edge. Also nail and glue six 6" spacers to one of the shelf disks. The 2" spacers are used as supports for the centers and legs as shown in photo No. 6. Sandwich the spacers between the disks with glue and nails.

Cover the space between the disks with strips of the 5/32" plywood. These must be cut across the outer grain so they'll bend around the rims. Nail them to the spacers and use glue around the edges of the disks. Nail and glue, or screw, the legs to the top and shelf. To position the top and shelf properly, I cut three pieces 10" long and used them as spacers until the legs were nailed in place. END

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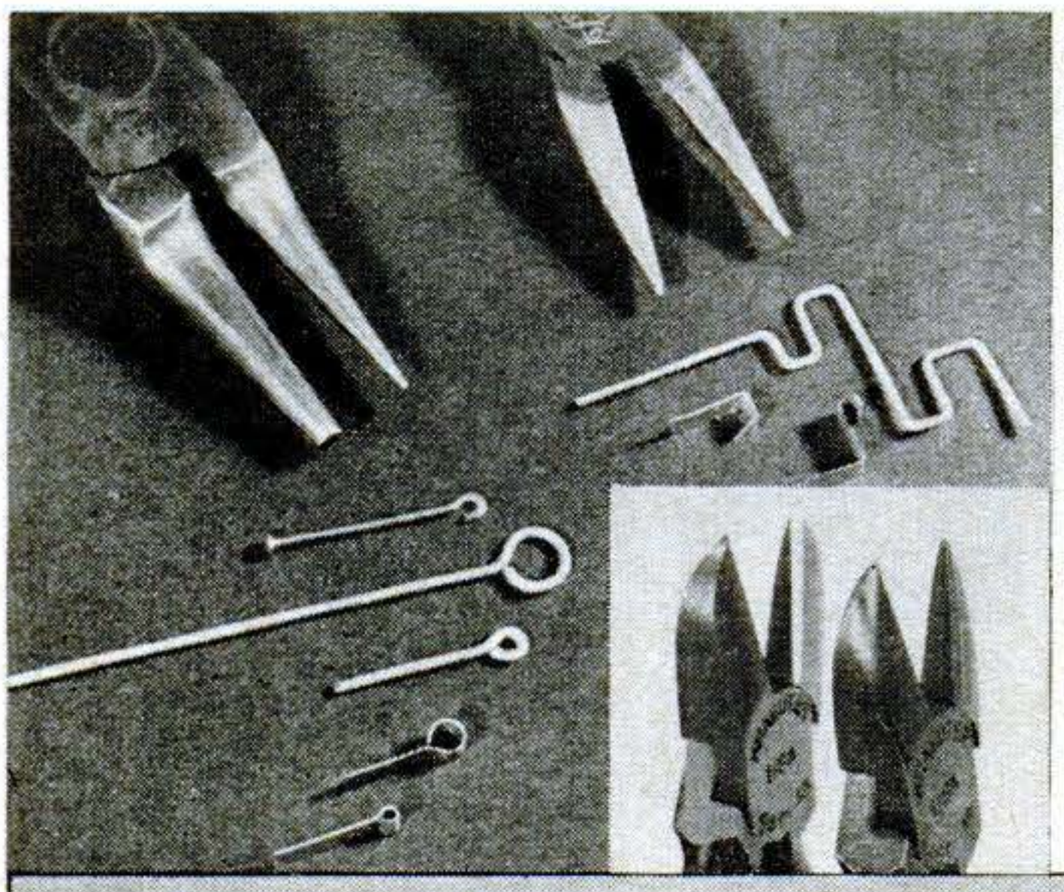
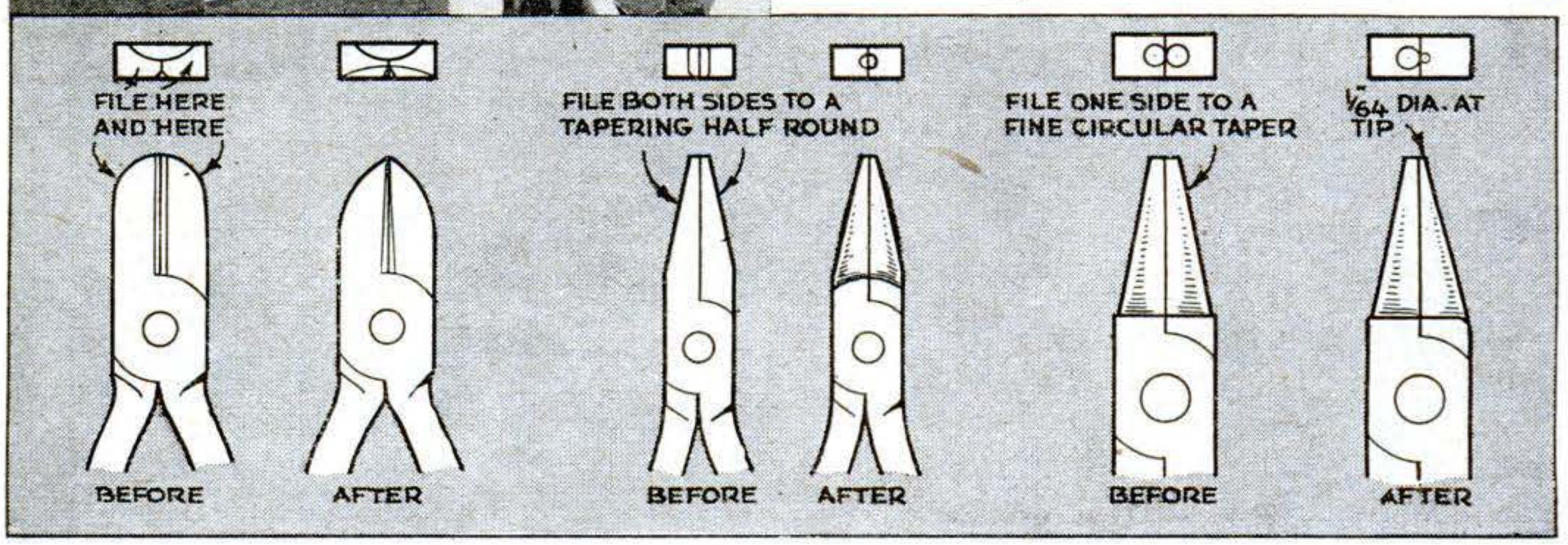
NEW SHOP IDEAS

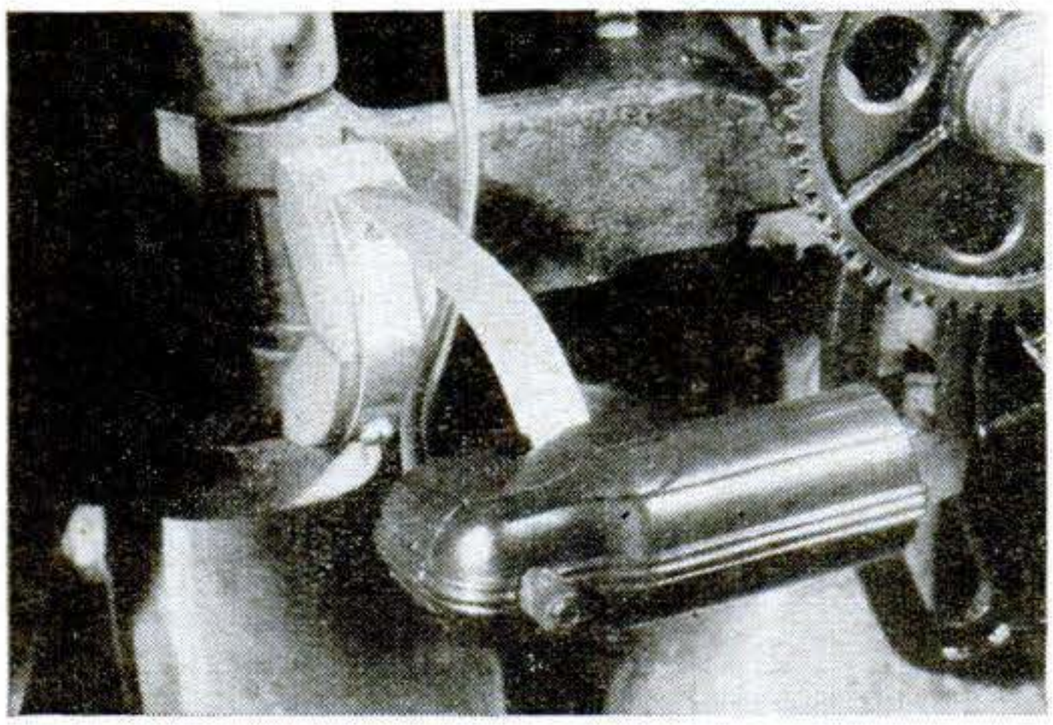


Tailor Your Own Tools. A model-maker often has trouble finding tools fine enough for his needs, but existing tools can frequently be adapted to suit. In the drawing below are three examples.

At the left, electrician's cutters were filed down to serve as clippers. With them you can cut off pins practically flush with the work.

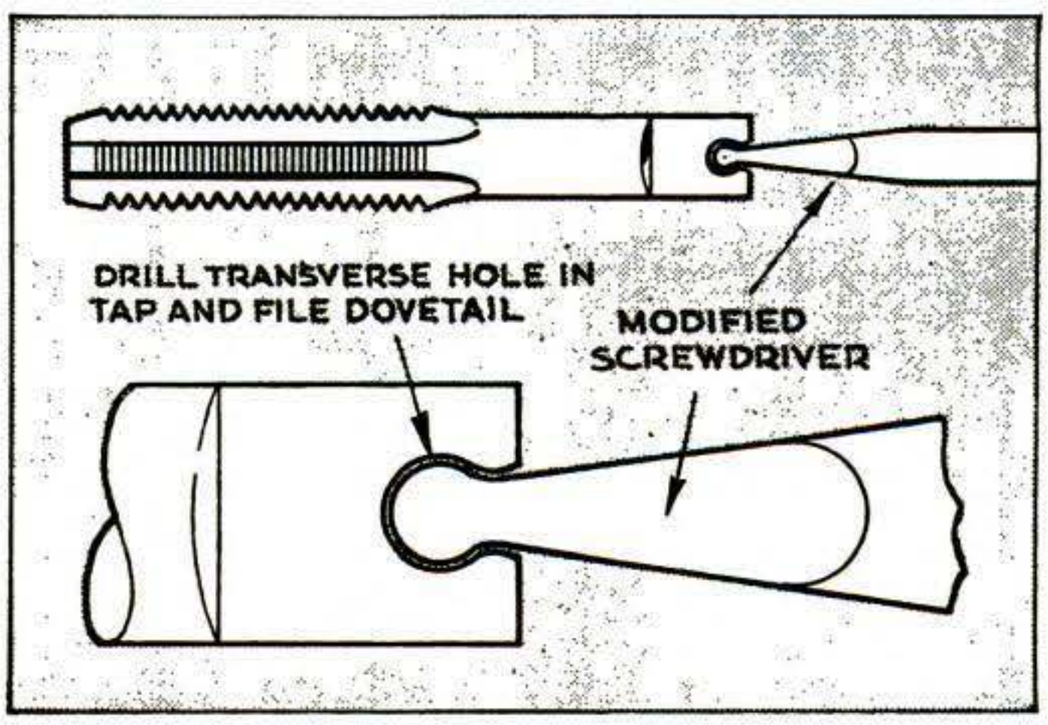
At the center, flat-nose machinist's pliers were filed to a tapering half round. In this form, they surpass tweezers for handling fine work. At the right, one jaw of a pair of round-nose bending pliers was filed almost to a point. With this tool, you can bend the many tiny eyes and hooks that add detail to models. File, don't grind, the tools.—*Herbert Pfister, Bronx, N. Y.*





Magnet Holds Light. Here's a useful trouble light for home shops. A small horseshoe magnet keeps it in place.

In addition to the magnet, you need a plastic night light intended for plugging into a wall outlet. Solder leads to the prongs on the light and wrap with insulating tape. Bolt or solder one end of a short strap of brass to the magnet and screw the other to the light. The strap can be bent to position the light where you want it.—*Will Thomas, Kenmore, N. Y.*



Tapping a Deep Hole. This idea came to me when I faced the problem of clearing damaged threads at the bottom of a 6″ hole—and had no tap long enough to reach. A modified screwdriver blade, locked to the tap shank as shown, did the job.

The same procedure can be used to tap new threads in soft metals if you don't overload the flutes and remember to apply plenty of oil.

Be sure the screwdriver point is not brittle.—*E. B. Bourassa, Nashua, N. H.*

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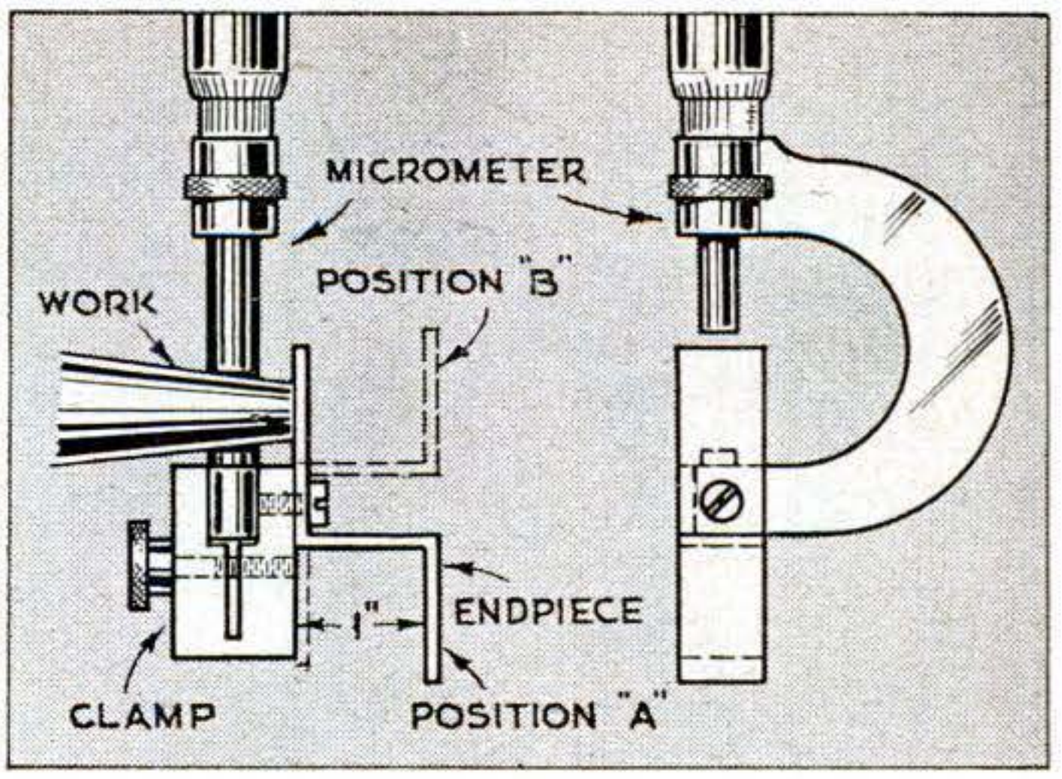
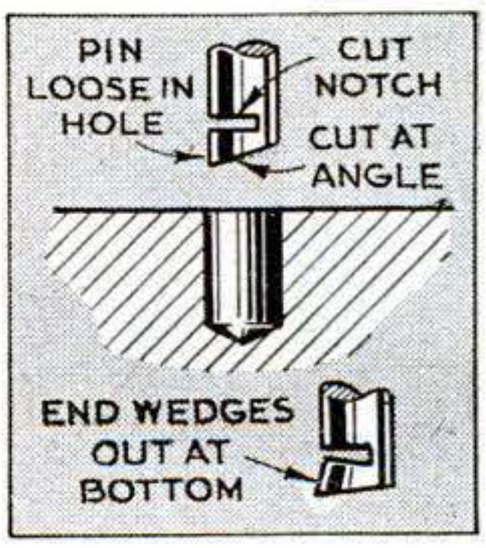
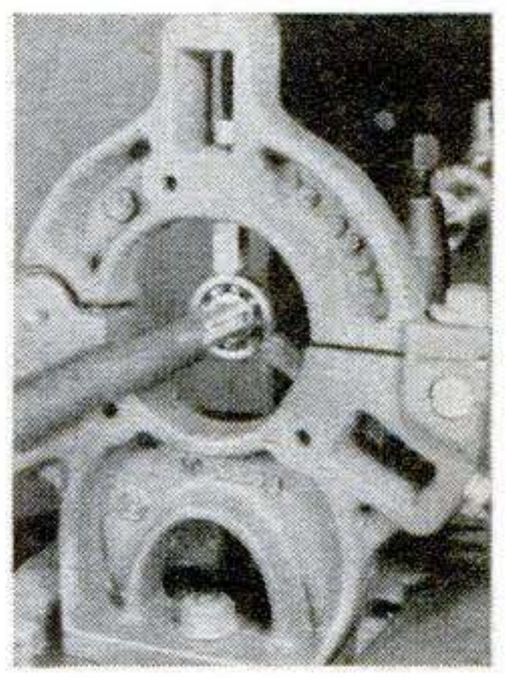
Measures Taper Per Inch. Placed on your micrometer in a moment, this attachment provides an accurate method of measuring taper per inch. It consists of two main parts—a clamp and an endpiece. The clamp fits over the outer jaw of the micrometer. After a measurement is taken in position "A", the endpiece is swiveled to position "B," the work advanced to touch it, and a second measurement taken. Since the distance advanced is exactly 1", it follows that the difference in measurement is the taper per inch.

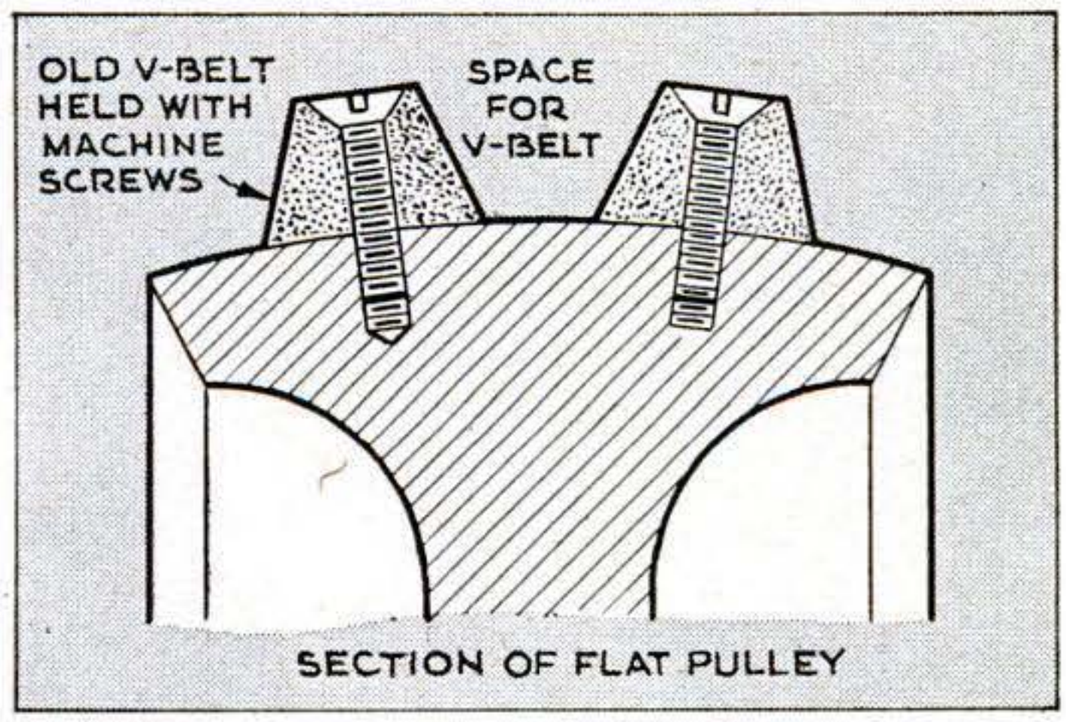


Anchoring Loose Pin. When a drive-fit pin has become loose because it or the hole is worn or out of round, this method will enable you to reset it. The pin may not be as tight as a new one, but in most cases the procedure will save time and material. Saw a notch near the bottom of the pin and cut this end at an angle. When you put the pin in the hole and hammer it down, the bottom will wedge outward, increasing the effective diameter of the pin.—*O. Fluharty, Indianapolis, Ind.*

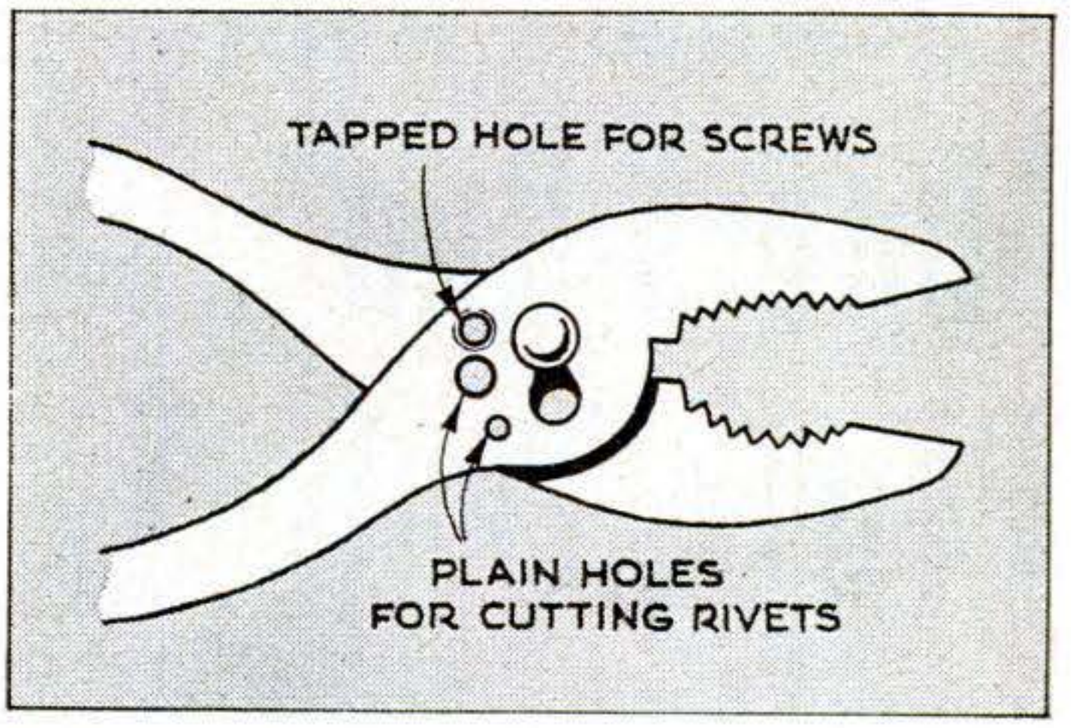


Bearing Supports Shaft. When you must turn down a long splined shaft or one that has an existing keyway or slot, it's next to impossible to use a steady rest. The problem can be solved by selecting a ball bearing with an inside diameter equal to the shaft diameter, slipping it over the shaft, and adjusting the steady-rest jaws to the bearing. Square or hexagonal bar stock can also be supported this way.—*J. C. Martin, Kings Point, N. Y.*





Pulley Adapted for V-Belt. In the shop where I work we needed a large V-belt pulley to drive a big blower, but there was none at hand. Instead of trying to buy one, we took a large flat pulley and screwed around it two lengths cut from an old V-belt. These were placed with the widest surface down and spaced just far enough apart to fit the V-belt we intended to use. On an extra wide flat pulley it would be possible to make spaces for two or more V-belts.—*George A. Kramer, Compton, Calif.*



Pliers Cut Rivets and Screws. To clip small rivets and screws without damaging the ends, drill holes through both parts of a pair of ordinary pliers, locating the holes near the pivot. The holes should be drilled, of course, while the pliers are part way open. The pliers I use for this purpose have three holes of different sizes, one being threaded for an 8-32 screw. After a screw is turned in and clipped, the threads clean the end when it is removed.—*J. H. Stevens, Elizabeth City, N. C.*

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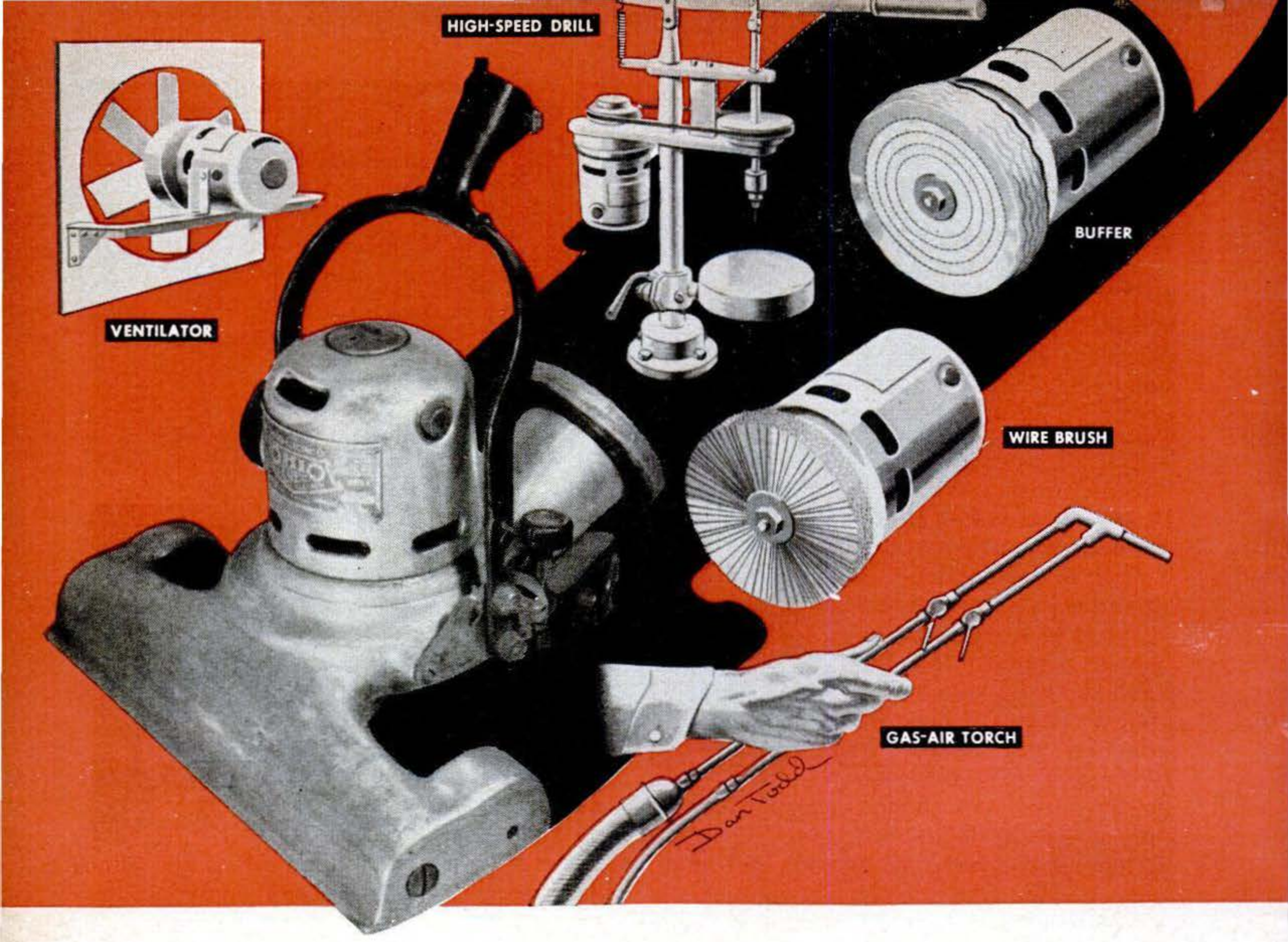

Vacuum-Cleaner Motors Run Power Tools

FOR light jobs around the shop, a vacuum-cleaner motor is hard to beat. Although these AC-DC series-type motors aren't husky enough to drive standard lathes, saws, and similar power tools, they are practicable for light grinding and buffing and for operating a high-speed flexible-shaft. Then, too, they'll take over such miscellaneous shop chores as driving a darkroom ventilating fan, supplying air for a gas torch or a smelting furnace, or driving a sensitive drill or a watchmaker's lathe. Not the least of their virtues is cheapness. They're often available in secondhand stores for a few dollars.

If possible, make sure the motor is in running condition before buying it; a short in the armature or field coils will make it hardly worth repair. With old motors, the commutator may be in poor shape, but this can be corrected by a light skimming cut in a lathe and by undercutting the mica if necessary. Don't forget in disassembling the motor that the fan nut often has a left-hand thread. Replace the brushes if they're worn short, taking care to orient the curved brush surfaces properly.

A photo at the top of the facing page shows one motor used to drive a small bench grinder and polisher. It's mounted on a ¾" plywood base. Rubber pads were placed beneath the motor to align its shaft parallel with the base. Then it was tied down tightly by stranded steel wires running to a pair of small turnbuckles underneath. Short lengths of hardwood dowel between the wire and base give clearance for tightening the turnbuckles.

Because the shaft had both shake and end play, a small ball-bearing arbor was devised. It's a short length of ¾" pipe bored out at

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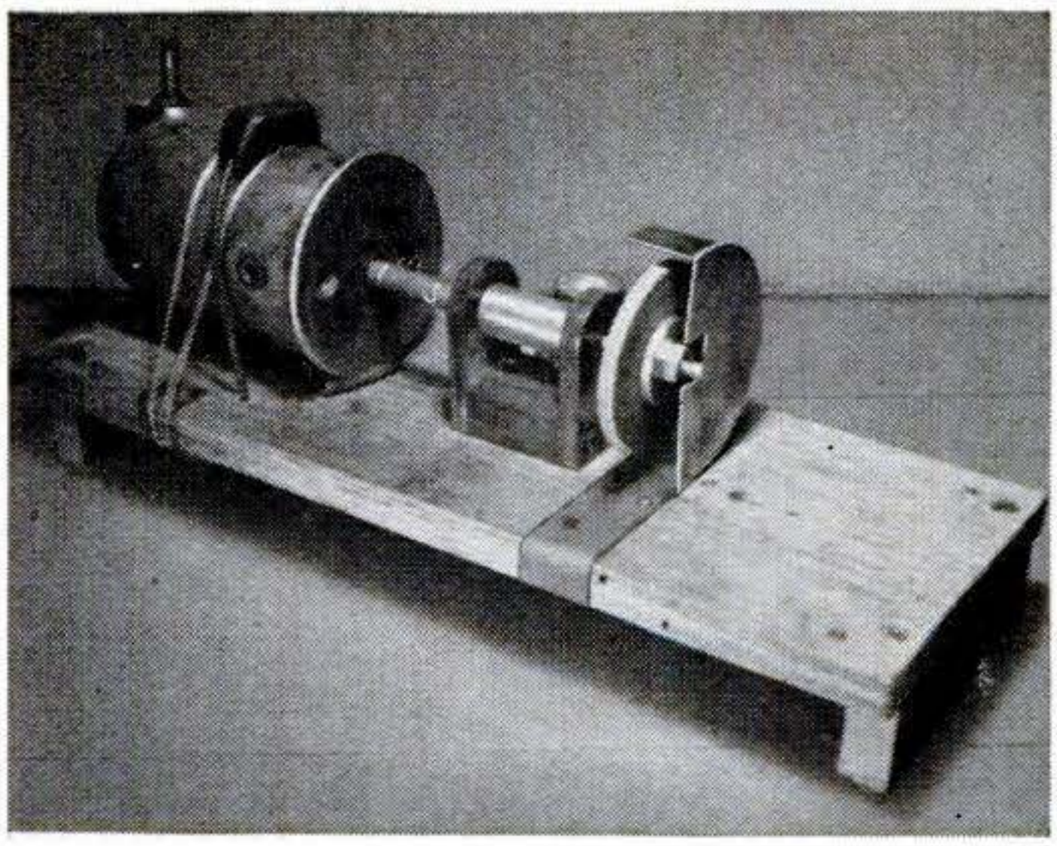
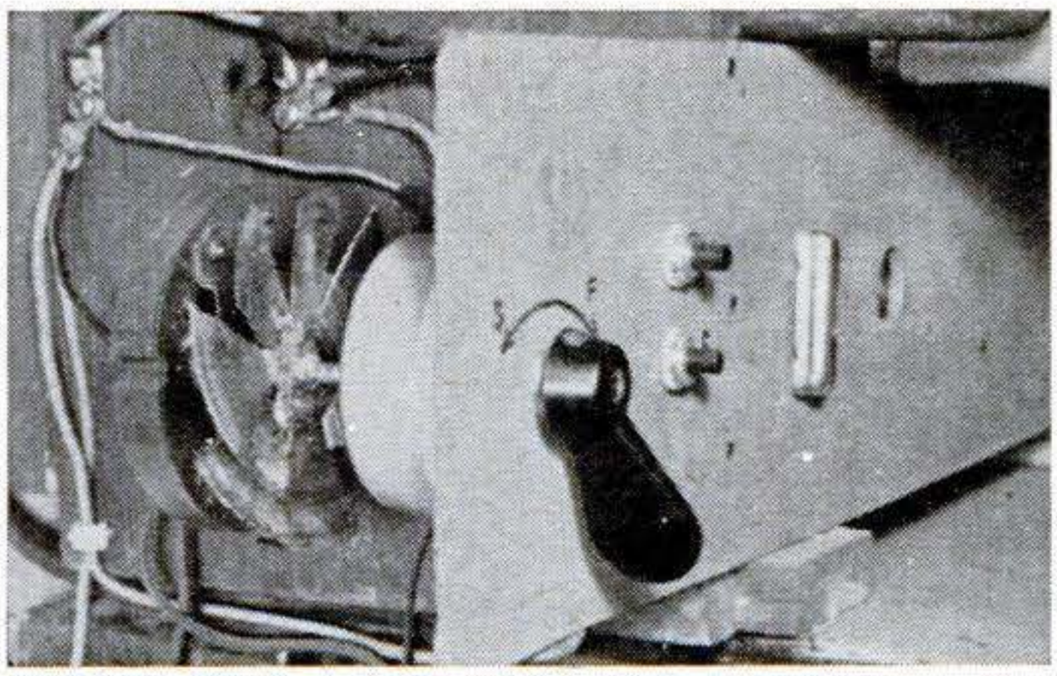


Bench grinder and polisher driven by vacuum-cleaner motor. Mounted on rubber pads, motor is anchored by stranded steel wires.

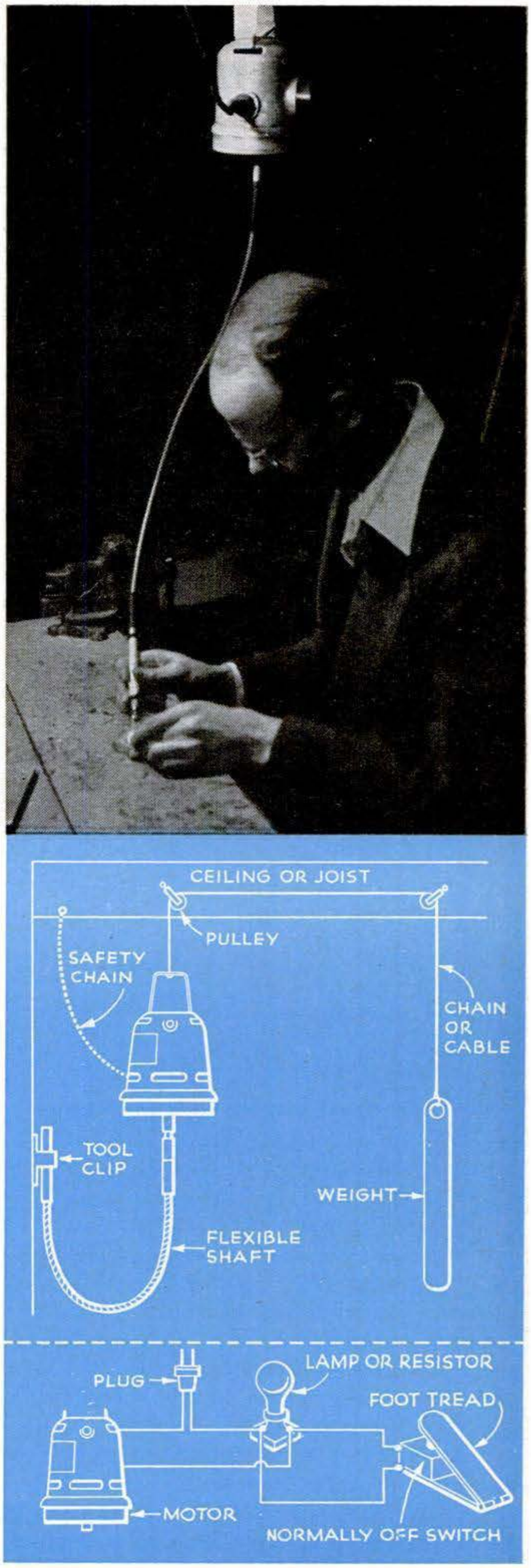


Rheostat of 50-watt rating will control cleaner motor if a small fan is hooked up to blow heat away from the resistance coil.

each end to take the bearings and held by two recessed plywood endpieces. The shaft, a piece of 5/16″ drill rod, was threaded in a lathe for the clamping nuts, to help get a wheel that would run dead true. Rubber hose makes a good motor-to-arbor coupling. A sheet-metal wheel guard is used during grinding.

Another excellent application for these motors is powering a flexible-shaft tool. Here the high speed of a series motor is especially helpful. So is the extra power of a vacuum-cleaner motor, which has more beef than small commercially made flexible-shaft outfits. A bench mounting can be used, but a counterbalanced overhead support is handy and compact. When you want to use the tool, just reach up, pull down the hand-piece, and turn on the juice.

Two pulleys, a bracket, a length of rope or furnace chain, and a counterweight are all you need for this mount. Another short piece of chain keeps the motor from turning as a result of reactive torque. The power cord to the motor is given enough slack to



Flexible-shaft tool powered by vacuum-cleaner motor is shown being used in top photo. Diagrams show setup of wiring and parts. Safety chain also keeps motor from rotating.

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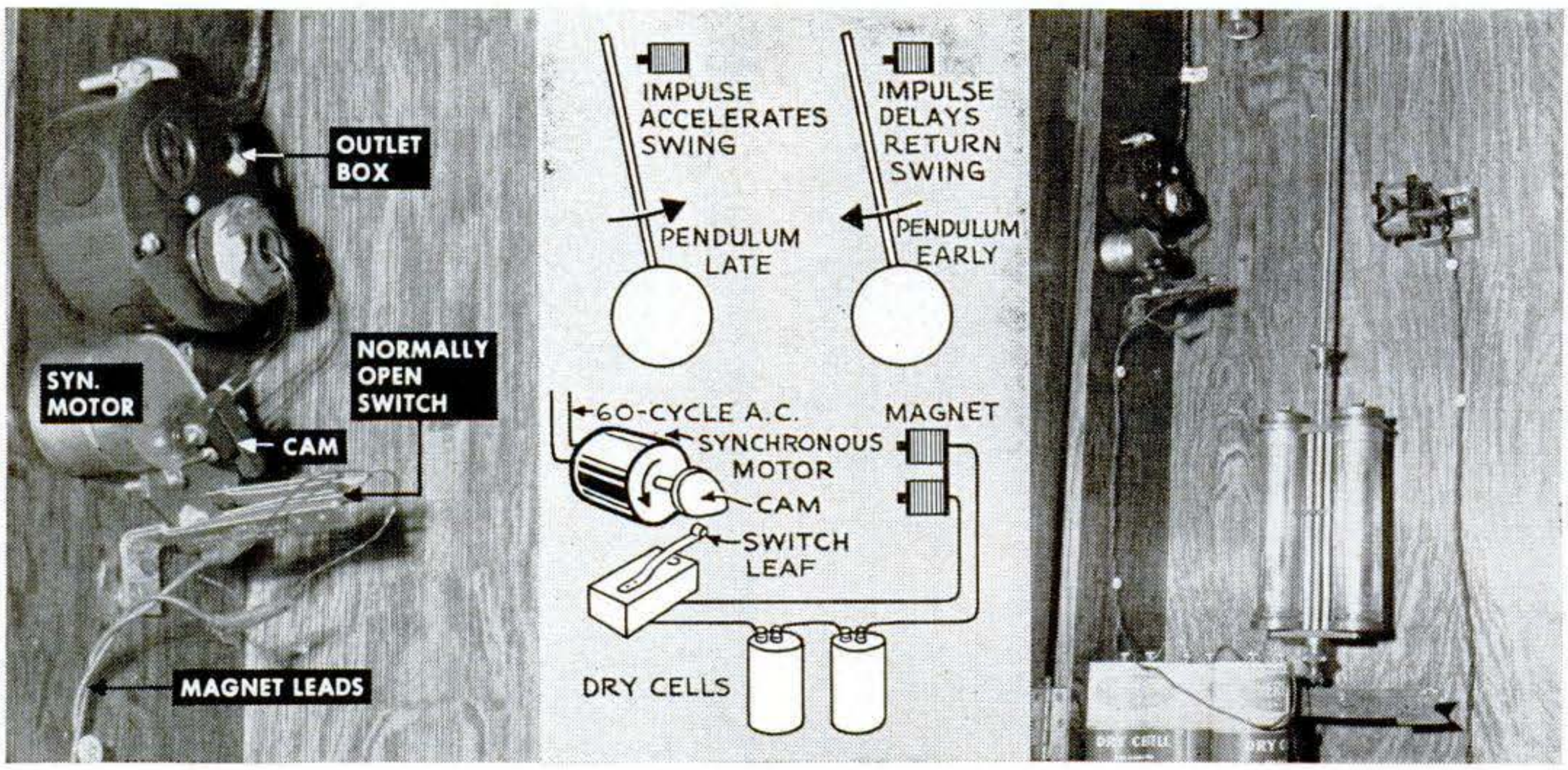
permit vertical movement. A tool clip screwed to a joist holds the handpiece.

Speed control of universal motors is important. Such motors should never be connected across full line voltage except under load. Connected to full voltage without a load, the speed may build up until the armature windings loosen. The simplest, but perhaps least satisfactory, speed control is a lamp socket wired in series with the motor. Depending on the nature of the load, 60-, 75-, or 100-watt bulbs are screwed into the socket. If the voltage is AC, a better control is a variable reactance. (PS, June '45, p. 190.)

Probably the best speed control is a heavy-duty rheostat of about 100 ohms maximum resistance and 100-watt rating. A rheostat made to control a sewing machine will serve. It's possible to use one of only 50-watt rating by mounting a small fan directly behind the rheostat. A small shaded-pole motor is mounted so that the blades blow the heat away.

Whatever speed control you employ, you'll find that a normally off footswitch is ideal. In grinding and buffing the load is intermittent and if you cut down the voltage so the motor won't run away when the load is off, you'll have inconveniently little power when the load is on. Here a footswitch lets you use full line voltage. END

Magnet and Motor Regulate Pendulum Clock



THE electrical device pictured above—installed on a spring-driven clock in an industrial plant—keeps the clock in perfect time but still allows it to run by itself if the power fails. When the power resumes, the device again automatically takes over the job of regulation. Of course, the clock must be kept wound; the electric power serves simply as a regulator. After a power failure, the only error in time will be the very slight one that may have developed while the clock was running by itself.

For a fraction of a second every six seconds the double-pole magnet is activated just as the pendulum reaches it. If the pendulum is swinging too slowly, the magnet, activated shortly before the pendulum reaches it, tends to pull the swing into step. If the pendulum is swinging too fast, the magnetic impulse comes slightly later and tends to hold back the pendulum's next swing.

In the left-hand photo may be seen the self-starting synchronous motor. It momentarily closes the normally open cam switch every six seconds. The switch contacts are connected to dry cells and thence to the magnet. Instead of each six seconds, the motor could be one that operated the switch every two seconds or a multiple of two.

First the clock is regulated closely when running by itself so the magnet has as little as possible to do to keep it in time. In the event of a power failure, the clock may gain or lose time, depending on how accurately it was regulated. It's highly improbable that the timing device and the pendulum will be in synchronism when the power returns, but if the gain or loss is not over six seconds, they'll come together again.—*A. W. McAuly, Pittsburgh, Pa.*

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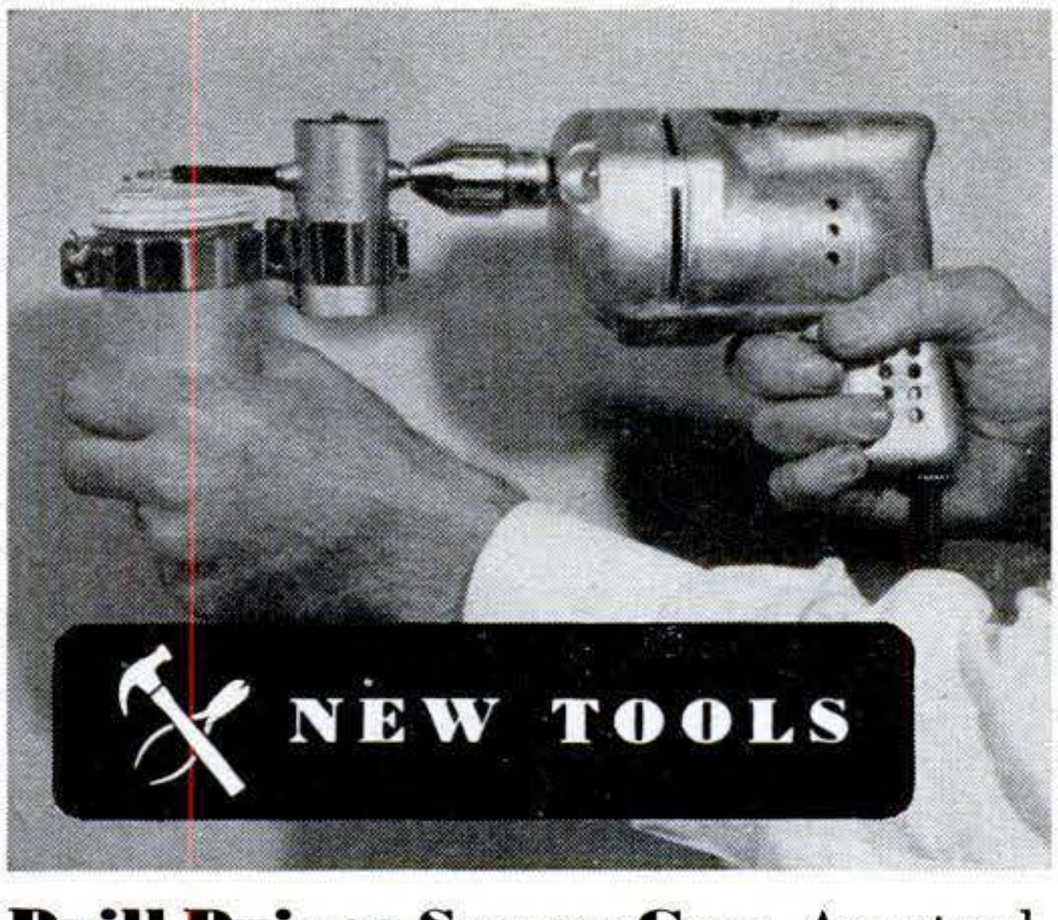
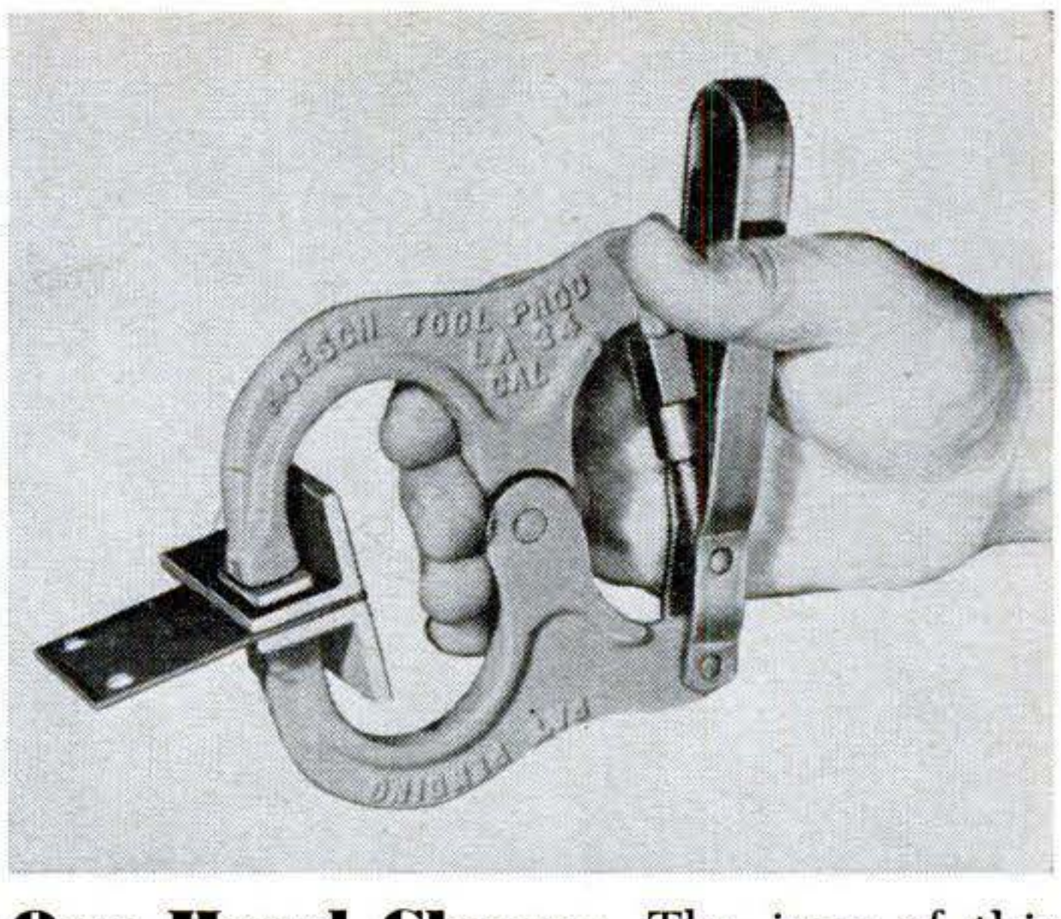
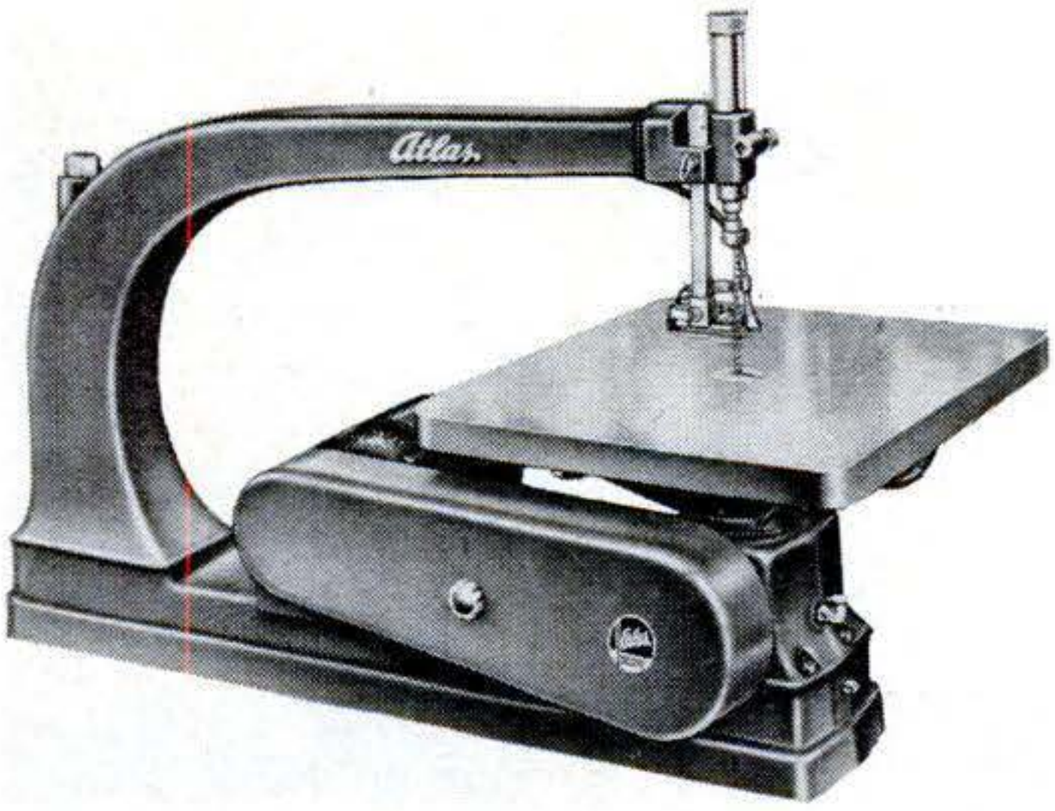


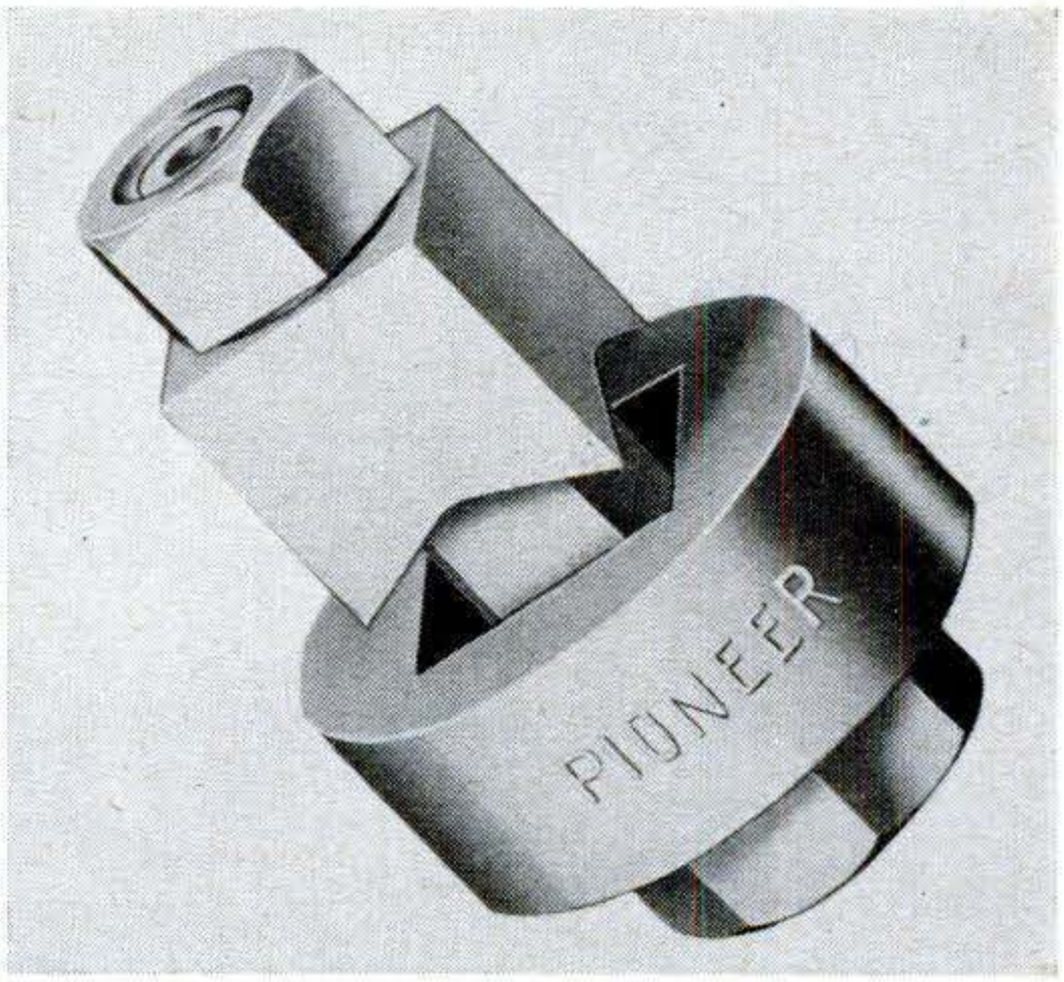
Drill Drives Spray Gun. Any standard ¼″ electric hand drill can be used to power a compact, self-contained compressor and spray gun announced by the F. R. Williams Company, Chicago. Weighing only 8 oz., the unit consists of an aluminum alloy casting fitted with bronze bearings. A steel strap clamp holds the paint container to the compressor, making it easy to remove the container for filling with paint.



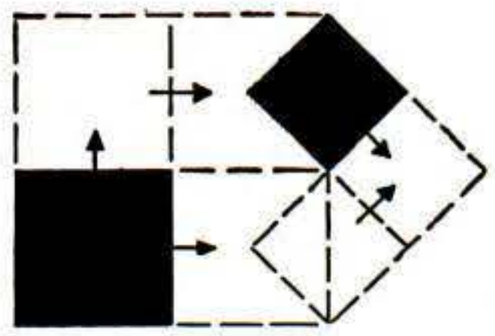
One-Hand Clamp. The jaws of this clamp open sufficiently so it can be used on material up to 1¼″ thick. An adjustable toggle handle enables you to put the clamp in position and lock it with one hand. The U-shaped jaws fit over angles, rolls, and other raised edges, and hold on either flat or irregular surfaces. Called the Quick-Action Clamp®, it's made by Roesch Tool Products, Los Angeles. Price is about $2.75.



Jigsaw Overarm Is Removable. A new 24″ jigsaw manufactured by Atlas Press Company, Kalamazoo, Mich., has an overarm that may be quickly unbolted to permit sawing large panels with saber blades. Another feature is a drive shaft that turns on ball bearings. The 14″ by 14″ iron table is supported by large trunnions spaced nearly 10″ apart to provide firm support for heavy stock. Chucks that take all types of blades and sabers up to 5/16″ wide and files up to ¼″ give the tool a high measure of versatility. Maximum depth of cut is 2¼″. Four-step cone pulleys afford speeds of 570, 858, 1,220, and 1,658 strokes per minute with a 1,725-r.p.m. motor.



Metal Punch. A punch which is distributed by the Pioneer Broach Company, Los Angeles, cuts square holes in sheet metal by screw action. It can be used to cut irregular openings, as seen in the sketch. The punch applies a double-action shear on each side of the metal as the nut is turned up with a wrench. A round hole is first punched for the screw bolt. The tool is made in two sizes, ⅝″ and ¾″ square.



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One side of the room includes a built-in desk, file cabinet, and bookshelves. For diffused light, frosted glass was placed in the window.

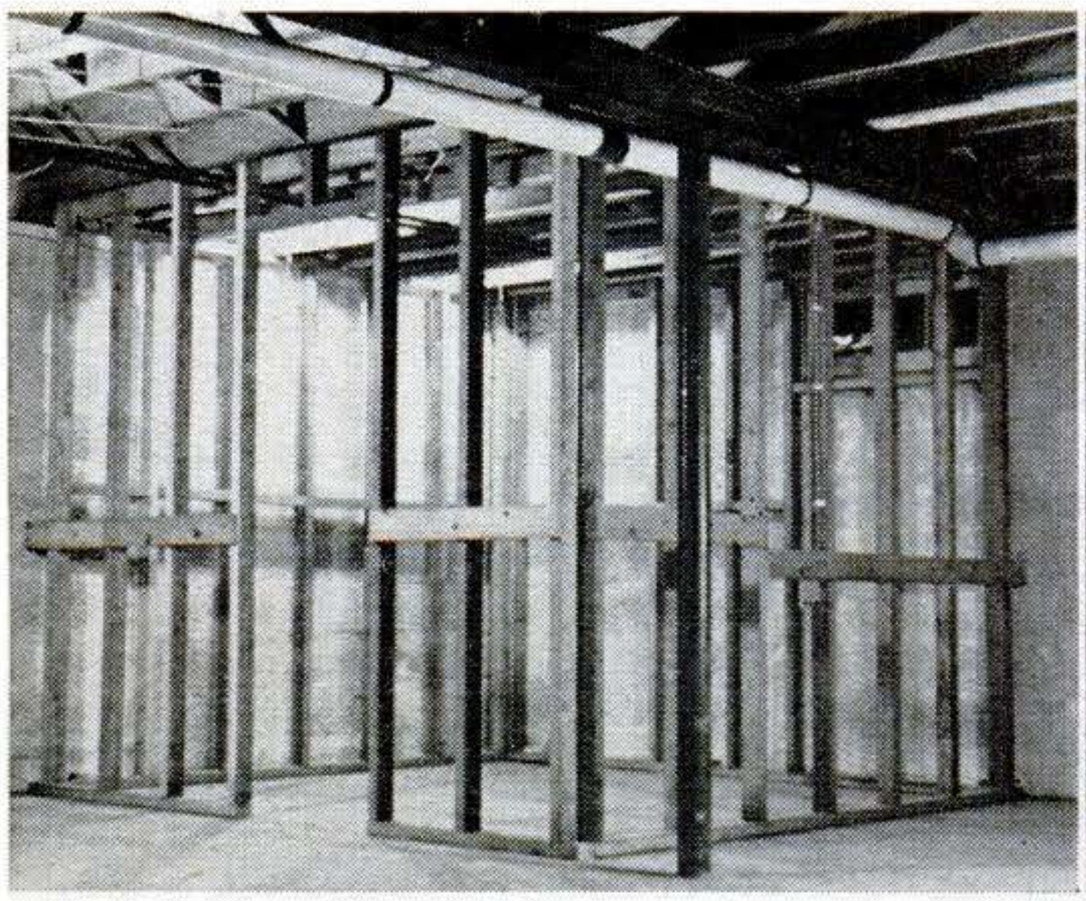
Opposite corner is devoted to darkroom work. The bench is built at a comfortable working height. There's shelf space for all equipment.

Den and Darkroom Built in Basement

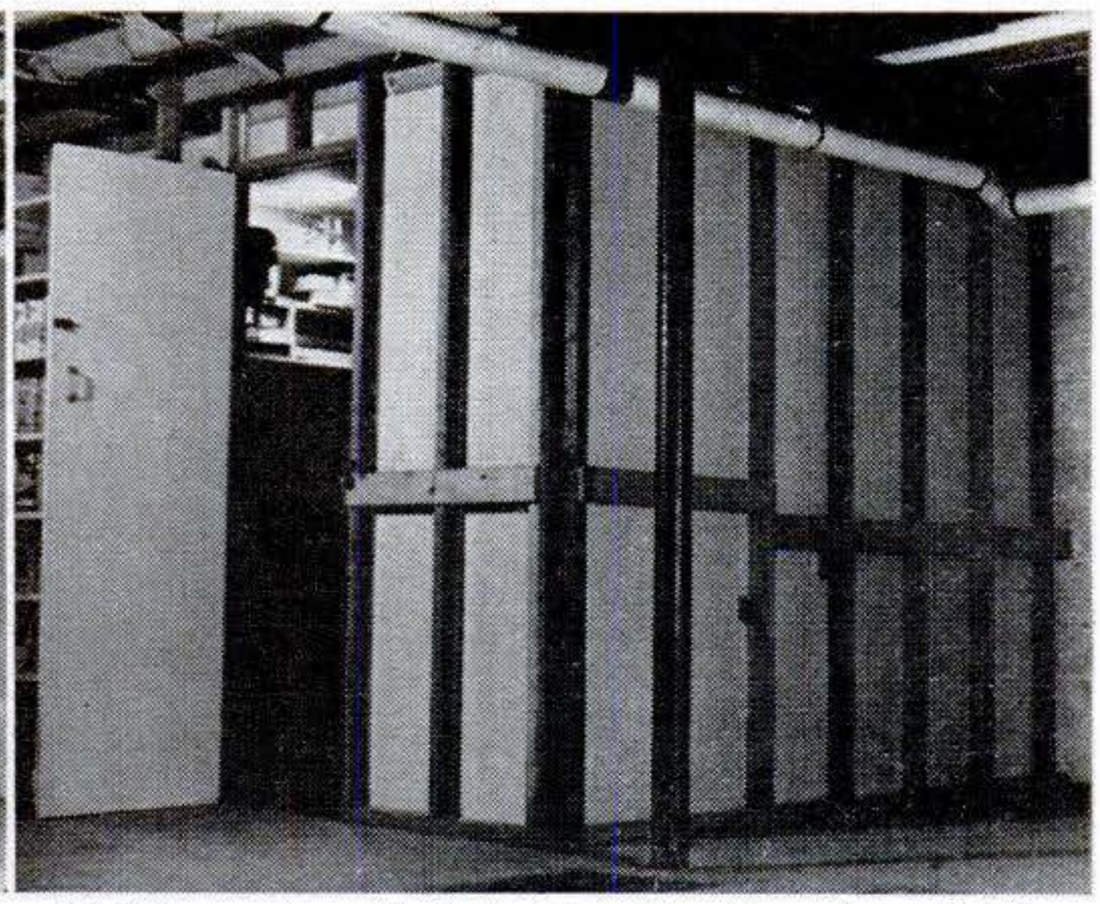
By Arthur M. York

GIVEN space in a dry basement, there's no reason you can't do exactly what this man did. A photographer and writer, he wanted to move his photo operations out of the kitchen, and he needed a personal retreat where he could work in peace.

He solved both problems by building a combination den and darkroom in an unused



A basement corner gave space for an 8′ by 8′ room. Holes were drilled in the cement floor and the frame anchored with expansion screws.



Wallboard nailed inside the framing finishes off the room. Two-by-threes were used for the frame. Door was built of pine and wallboard.

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corner of his basement. Surprisingly enough, considering today's prices, he spent just a trifle less than $75 for materials.

His 8′ by 8′ room is not just a hole-in-the-wall either. It includes a built-in desk, book shelves, photo workbench, recessed lighting, and ample room for a file cabinet and chairs.

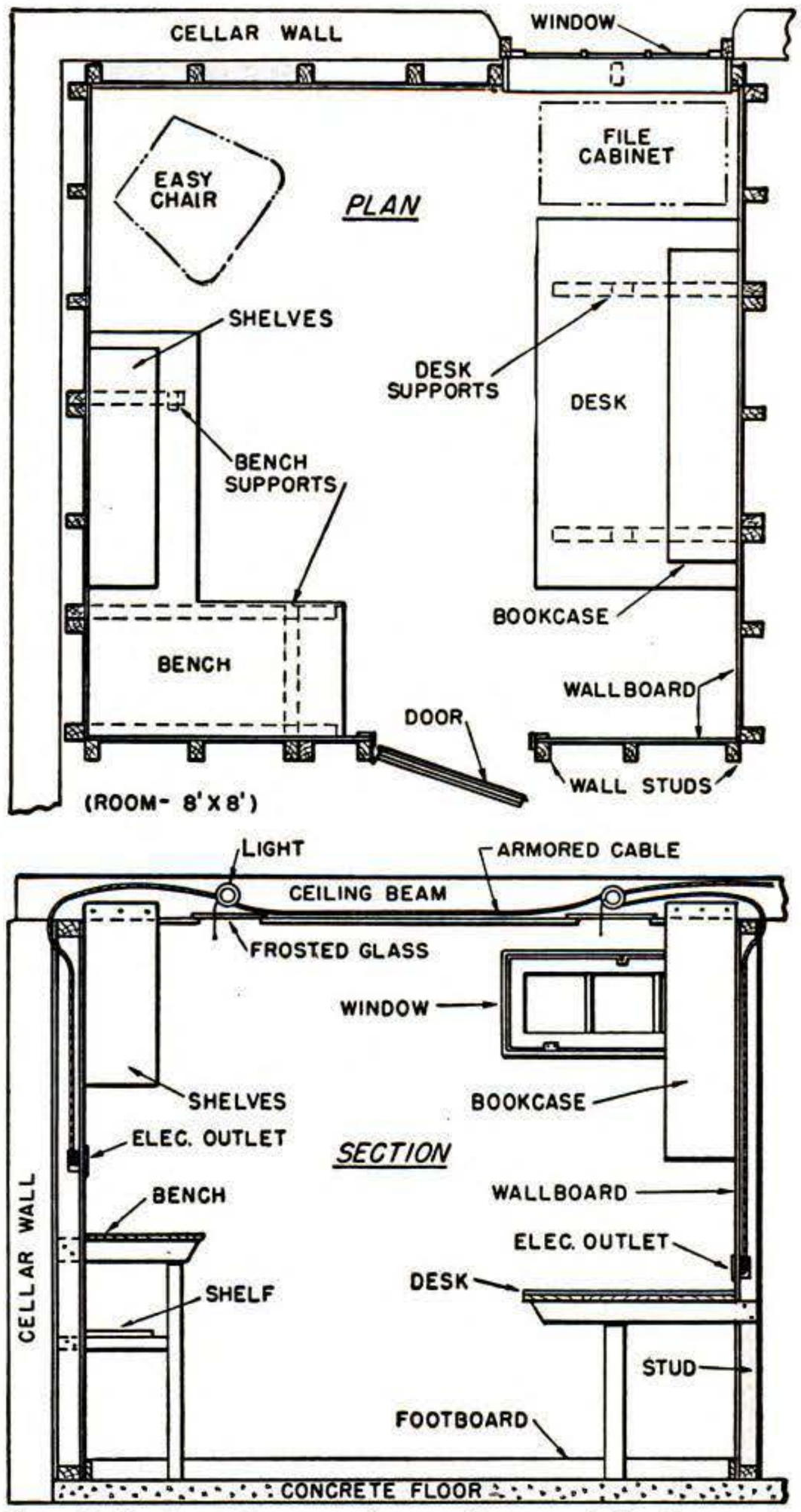
Although running water and sink are not provided inside the room, this offers no particular hardship. The laundry tubs are located just outside the door. Photos are washed there.

The room was framed with two-by-threes, the studs being spaced 16″ apart. This lumber, incidentally, accounted for the largest single item in the cost—about $21.

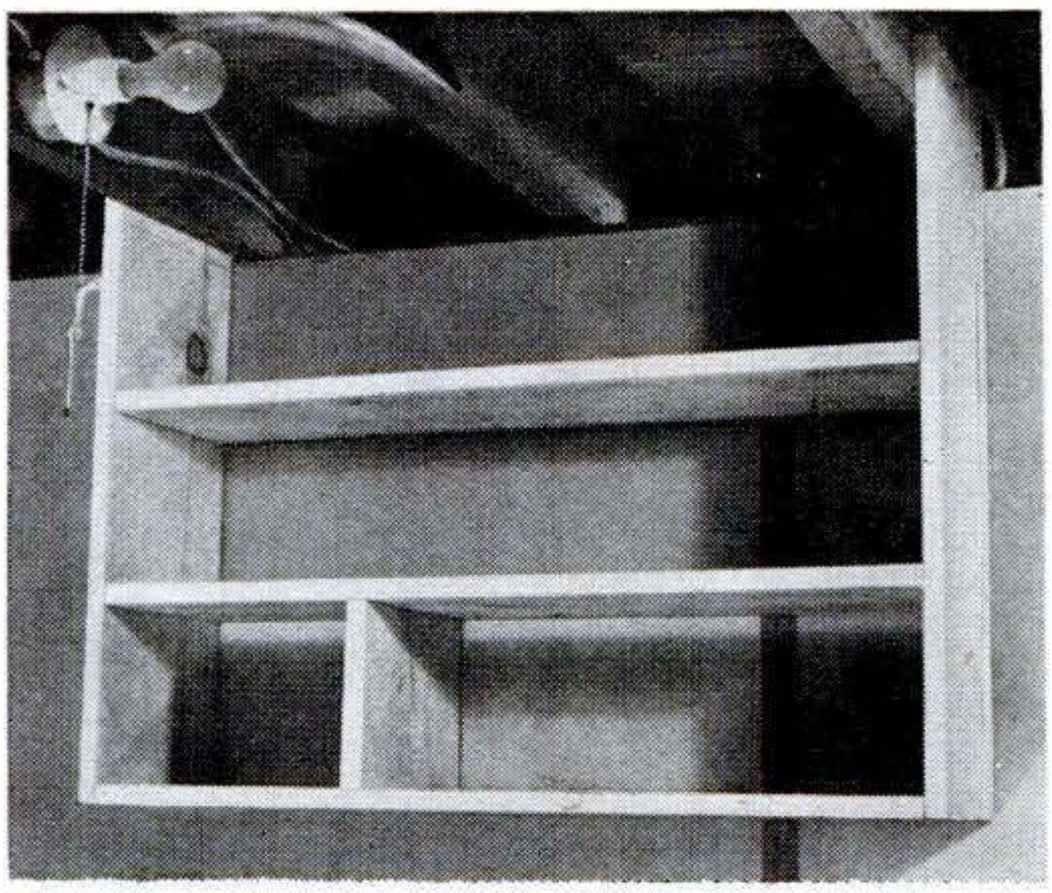
After the frame was up, the electric wiring was taken care of. About 30′ of armored cable was required for this, provision being made for three ceiling lights and two convenience outlets.

With the wiring complete, the walls and ceiling were sheathed with 5/32″ fiber wallboard. Joints were sealed with ordinary gummed paper tape. A 3″ kickboard was placed around the base and all wall and ceiling corners finished off with ¾″ quarter-round.

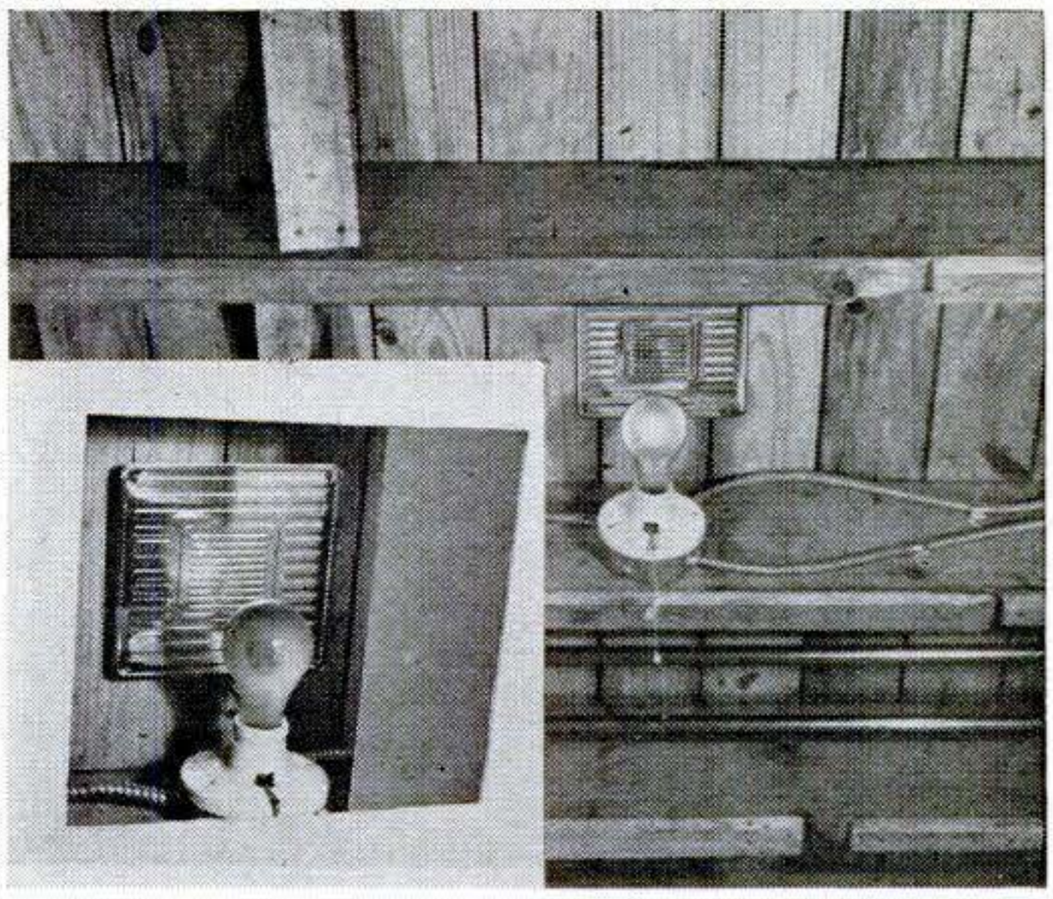
Rather than buy expensive lighting fixtures, the builder decided to install recessed lighting—over the desk, workbench, and easy chair. Low-cost porcelain sockets were installed between the ceiling beams at these locations, and square openings cut in the ceiling sheathing just underneath. A metallic hot-pan mat from the dime store was placed above each light to serve as a reflector. Bulbs can be replaced by sliding back



Careful planning made good use of the limited space. A cellar window was included within the room to give ventilation and some natural illumination. The concrete floor was painted.



Hanging shelves on two sides of the room save floor space. These were nailed to the overhead beams before ceiling sheathing was installed.



Wiring was done before putting up wallboard. Inset shows one of three concealed lights in the ceiling. Frosted glass rests over opening.

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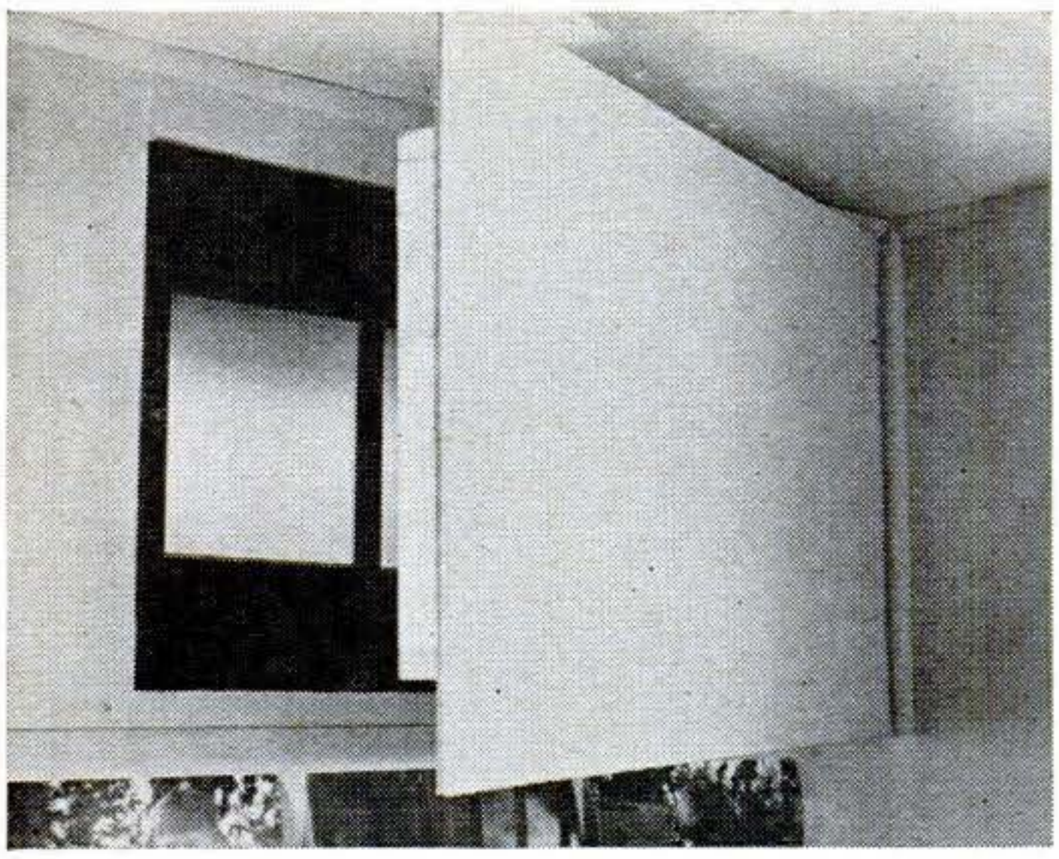
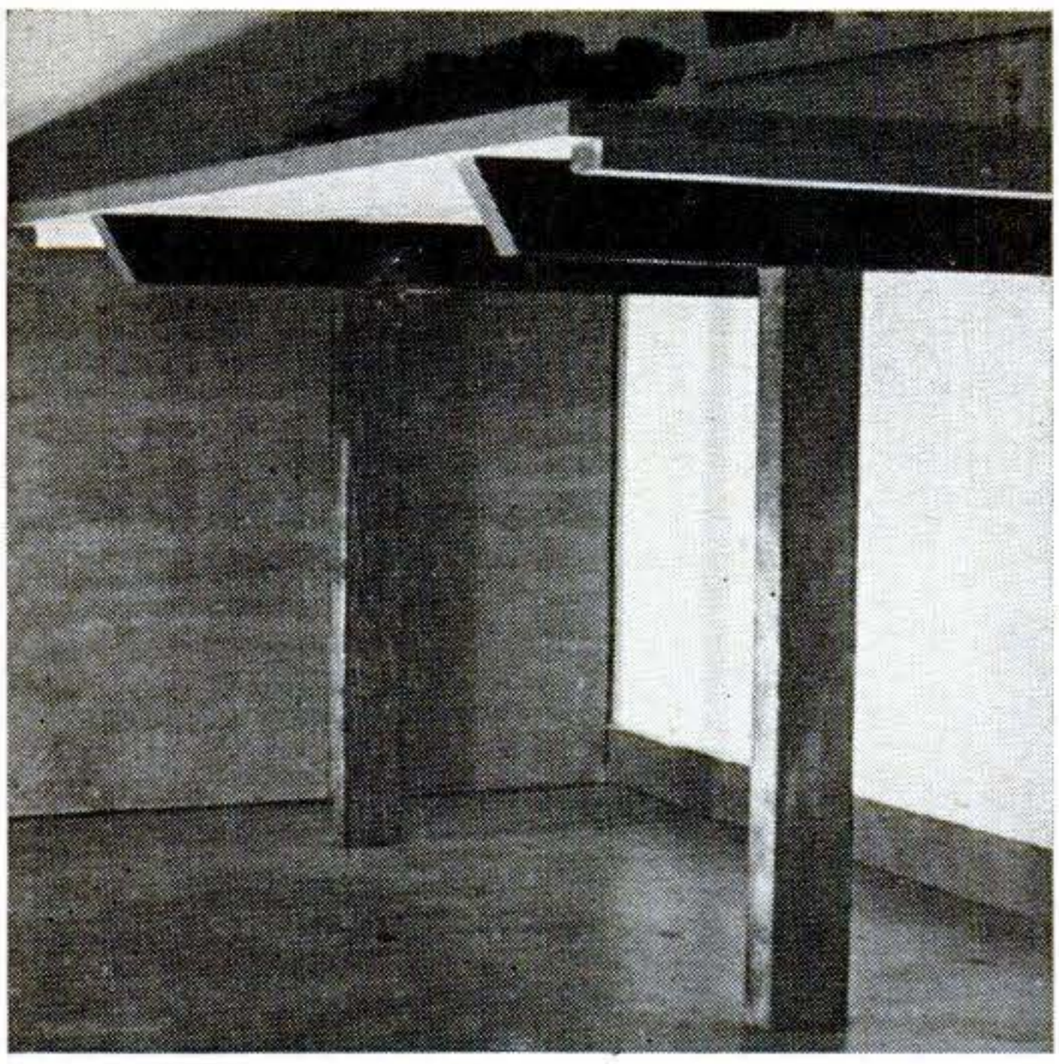


A removable cover blacks out the window while photo work is in progress. It consists of a wood frame covered with a piece of wallboard.



The desk is simple but sturdy. Two horizontal members were nailed to the wall studs. The pine top was covered with wallboard and painted.

the frosted glass that covers the enclosures.

Side members for the bookcase and shelves were nailed to the ceiling beams before the sheathing was installed. Simple butt joints were used for the shelves. Pine 10″ wide was the stock here.

Although the 30″ by 54″ desk is extremely simple, it's sturdy and does everything a desk should. Two horizontal two-by-threes were nailed securely to the wall studs. Two legs, made of the same material, support the horizontals about two-thirds of the way out from the wall. Small angle brackets between the legs and horizontal members give the desk rigidity. The top consists of pine boards, covered with a sheet of wallboard.

A photo workbench was built in the same way, except that additional horizontal members were located midway on the legs to brace them and support a shelf. Here, however, the fiberboard top surface was omitted. Instead, the pine working surface was simply given two coats of a red rubber-base paint. Spilled photo chemicals wipe off without leaving a stain.

The same paint was applied directly to the existing concrete floor and to the top of the desk. On the floor, the result is a smooth surface that wears well and that cost only a fraction as much as an asphalt-tile or linoleum covering.

The walls and ceiling were given a coat of a peach tint water-base paint, the shelves were enameled white, and the table and bench legs, window frame, and footboard were stained with mahogany varnish.

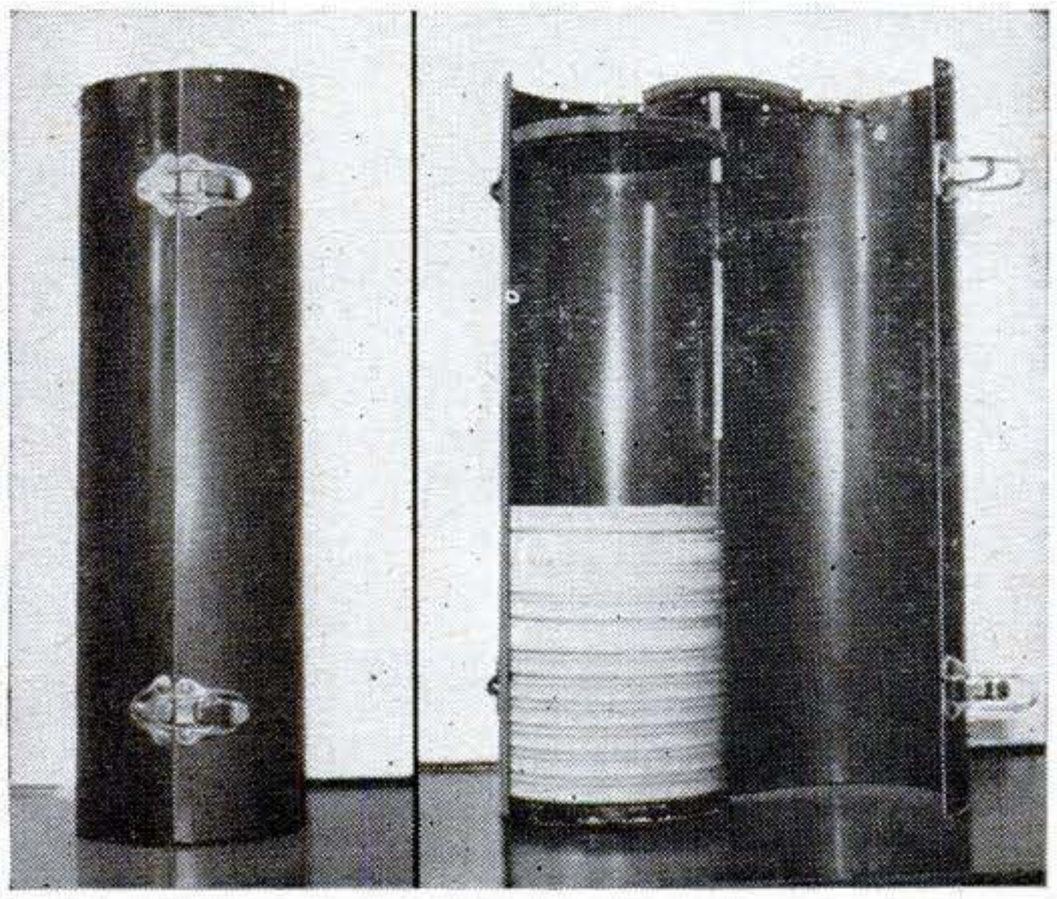
A door was built of pine boards, held together by three crosspieces, and then covered with a sheet of wallboard. END

Movie Reels Carried in Case Made of Stovepipe

HERE'S a handy carrying case for your movie reels. Made from 6″ self-locking stovepipe, it stands 17½″ high and accommodates 24 ordinary 200′ reels.

After compressing the pipe until it just suited the 5¼″ diameter of the reels, I cut it lengthwise into halves. Then I hinged the parts together, drilling the metal and using rivets to attach the hinges. On the other joint, I installed two suitcase catches, locating these to take care of the overlap.

Inside each end of one half I screwed a 5¼″ disk of ⅜″ plywood. A chain pushed through a piece of hose is fastened to one end as a handle.—*Norman Maire, Beaver, Pa.*



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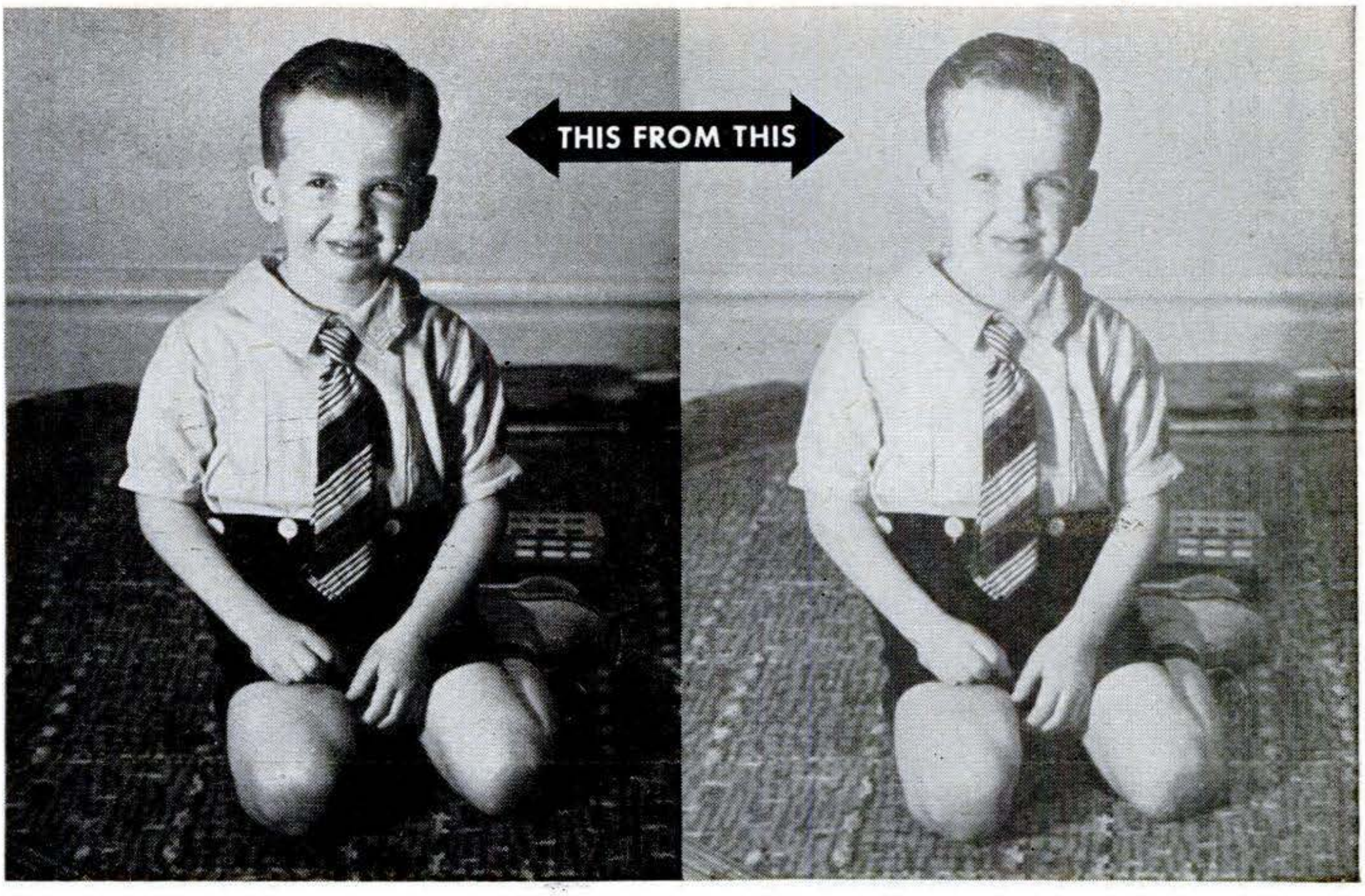


How to Revive Faded Photographs

PRINTS or negatives that have faded can be easily restored by bleaching and redeveloping. Fading results from the reaction of the silver image with hydrogen sulphide in the air or sulphur compounds in the emulsion.

First immerse the print in a formalin hardening bath for three minutes. Make this by adding ⅓ oz. of 37 percent formaldehyde and 73 grains of sodium carbonate to a quart of water.

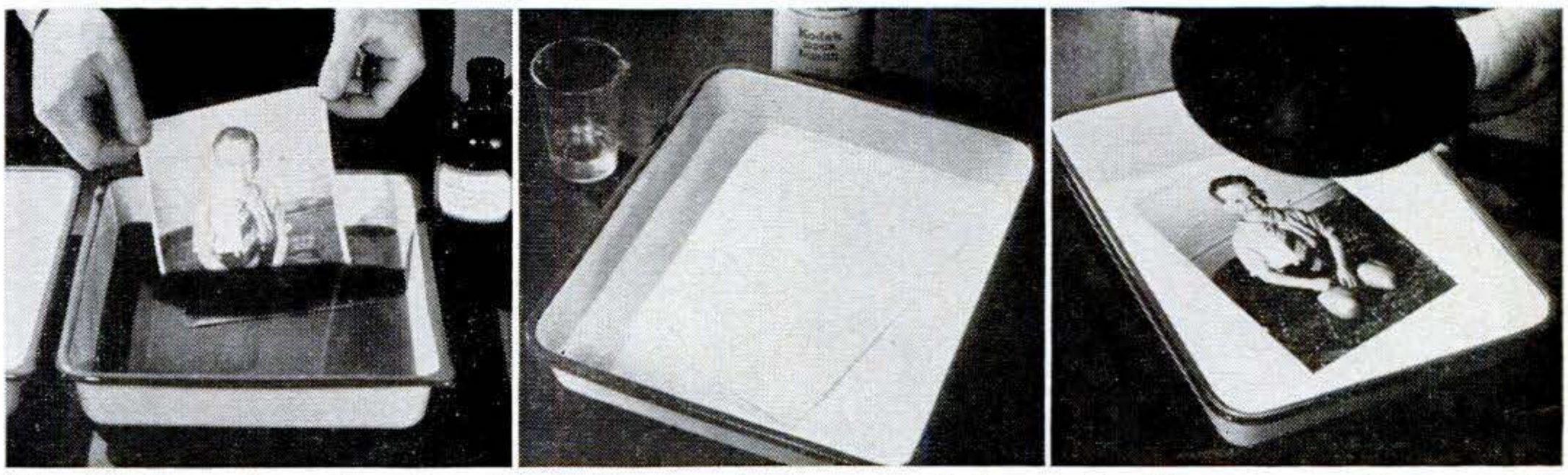
After rinsing the print for five minutes, put it into a bleach made of two stock solutions. The first consists of 37 grains of potassium permanganate in 16 oz. of water. The second is made by adding ¼ fl. oz. concentrated sulphuric acid and 1¼ oz. table salt to 16 oz. of cold water.

For negatives mix equal parts of the solutions. Do likewise for prints, but dilute with 2 parts water. Immerse print until the image has almost disappeared.

Remove the brown stain by immersing the print in a 1 percent solution of sodium bisulphite. Then rinse thoroughly and redevelop in any nonstaining developer.

Do this under strong light. Then wash for 10 minutes and dry. No hypo is necessary.

If a negative or print is irreplaceable, it may be best to make a copy negative first.



Bleach the print after first hardening emulsion in a formalin bath. Leave the print in the bleaching solution until image has almost disappeared (center). Then remove brown stain by immersing in sodium bisulphite solution, rinse well, and redevelop under strong light.

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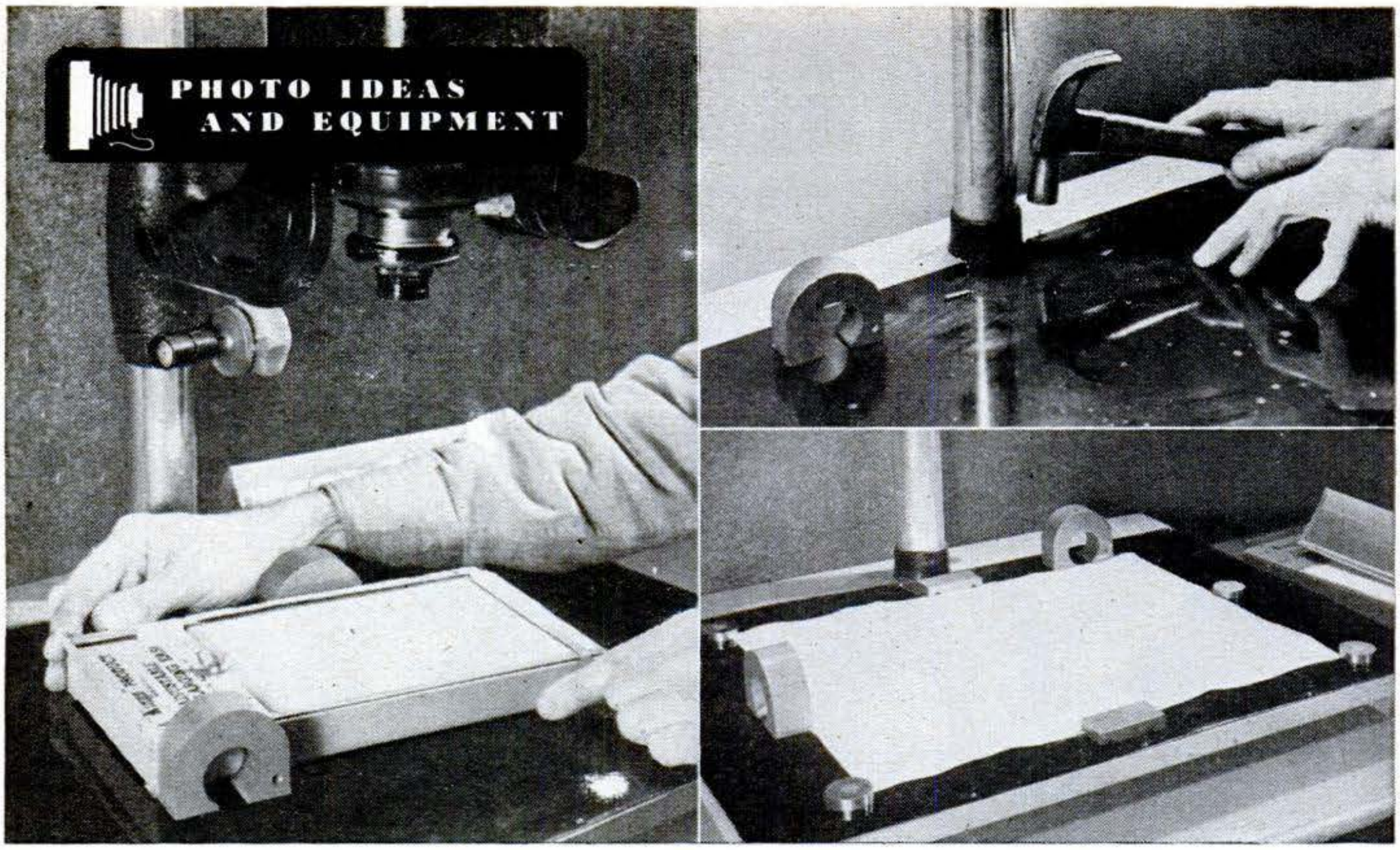
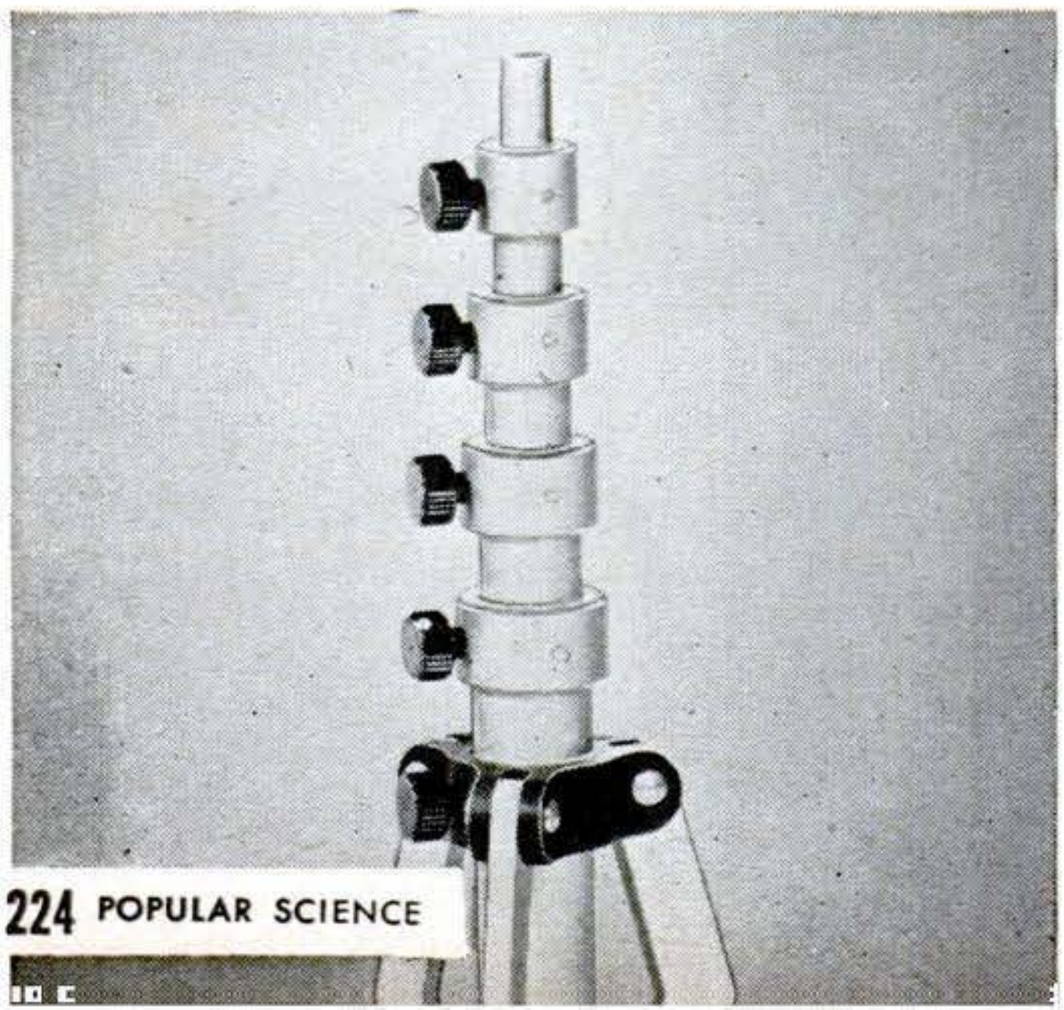


Magnets Hold Enlarging Paper. Two or more high-power permanent magnets and an old ferrotype plate will give you a smooth-working method of holding an easel of enlarging paper in place under an enlarger. Cut an iron ferrotype tin, or any other ferrous sheet metal, a bit smaller than the baseboard and tack it to the latter through predrilled holes. Wax and polish the metal and the faces of the magnets that will contact it.

An all-steel paper holder works best. If the holder is nonferrous material, fasten strips of steel along the edges. Several small magnets can also be used to hold large sheets directly on the steel base.

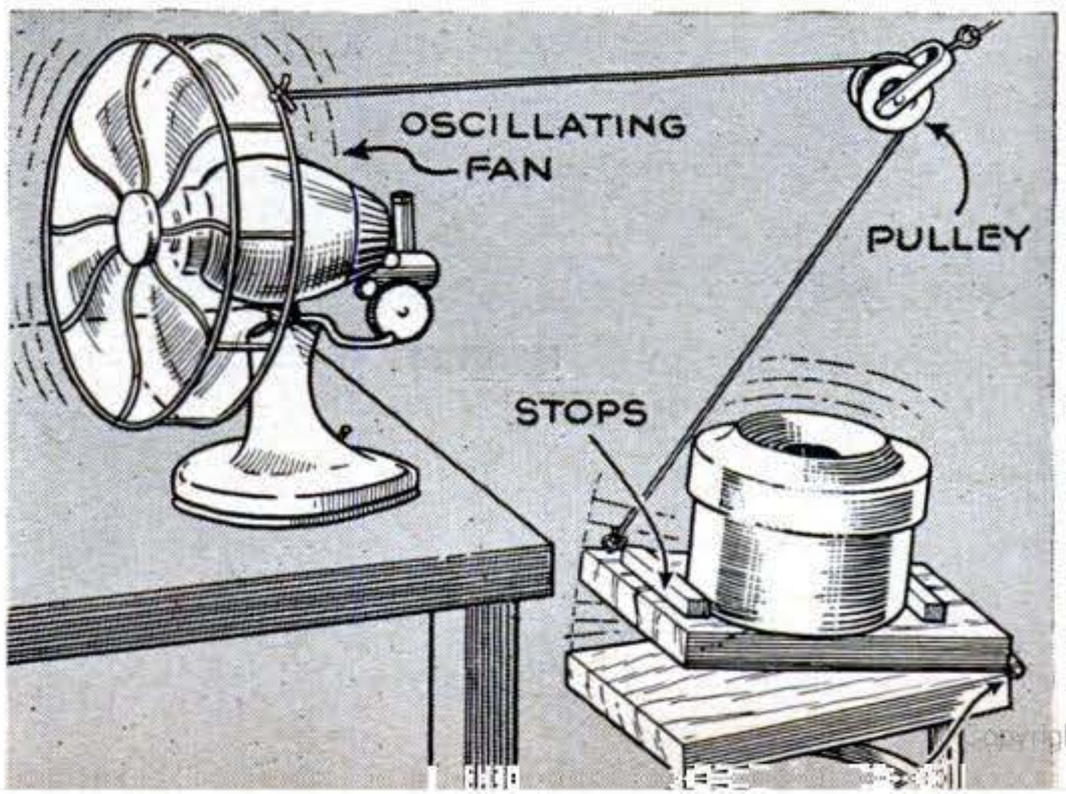
New Light Stand. Made of dural, the photographic light stand below weighs very little and collapses to a compact length. When fitted with a ¼″-20 thread adapter, it also serves as an emergency camera support at low levels.

A product of the American Photographic Instrument Co., New York, it's made in four sizes—18″, 20″, 24″, and 26″ collapsed length. The 18″ model extends to 7′, weighs 25 oz., and sells for about $12. Dimensions and prices of the others are in proportion.



Film Backing Darkens Room. You can make your darkroom light tight by covering small cracks or spaces around doors and windows with strips of roll-film backing paper. Cellulose tape or thumb tacks can be used to keep the strips in place over the cracks.—*Sol Tepfer, Brooklyn, N. Y.*

Fan Agitates Tank. Here's how I agitate the solution in my roll-film developing tank. The tank rests on a hinged platform. A string attached to one end of the platform runs through a pulley to an oscillating fan, which is fastened securely to its support.—*John Brush, Gorham, Maine.*



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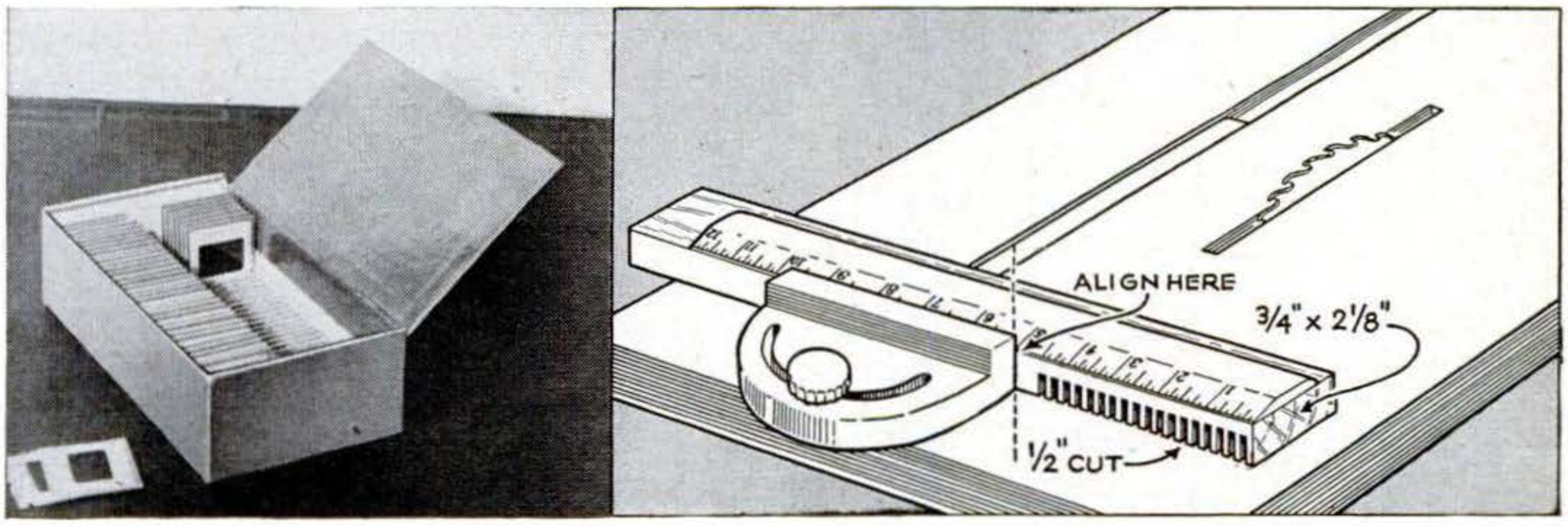
It Wasn't a Snapshot! Amateurs may simply raise a camera and shoot, but that's not how professionals work. For the photo at right (see page 110), PS Photographer W. W. Morris spent eight and a half hours assembling props, setting them up, and arranging the lighting before he clicked the shutter. Above is a picture of the picture-taker taking the picture.

To give cross lighting, three No. 3 Wabash photoflash bulbs were placed in focusing reflectors atop the ladder at the far left. A G.E. No. 5 was located on the floor ahead of the camera and two G.E. 22s on the ladder at right. All lights were tied into a booster box. From this a 45′ lead ran to the photographer. The shot was made with open flash at f/22. Simultaneously, another photographer snapped the photographer.

Slides Stored in Cigar Box. From a cigar box 2½″ or more in depth, you can make an excellent file for 2″ by 2″ slides. It will hold 65 to 70.

Make two holders from a strip of ¾″ by 2⅛″ hardwood, cutting each long enough to suit the box. Set the table saw for a ½″ cut and make the cuts ¼″ apart. Sand the slots. Wedge a dividing strip 1″ high between the holders.—*Ralph S. Wilkes, Keuka Park, N. Y.*



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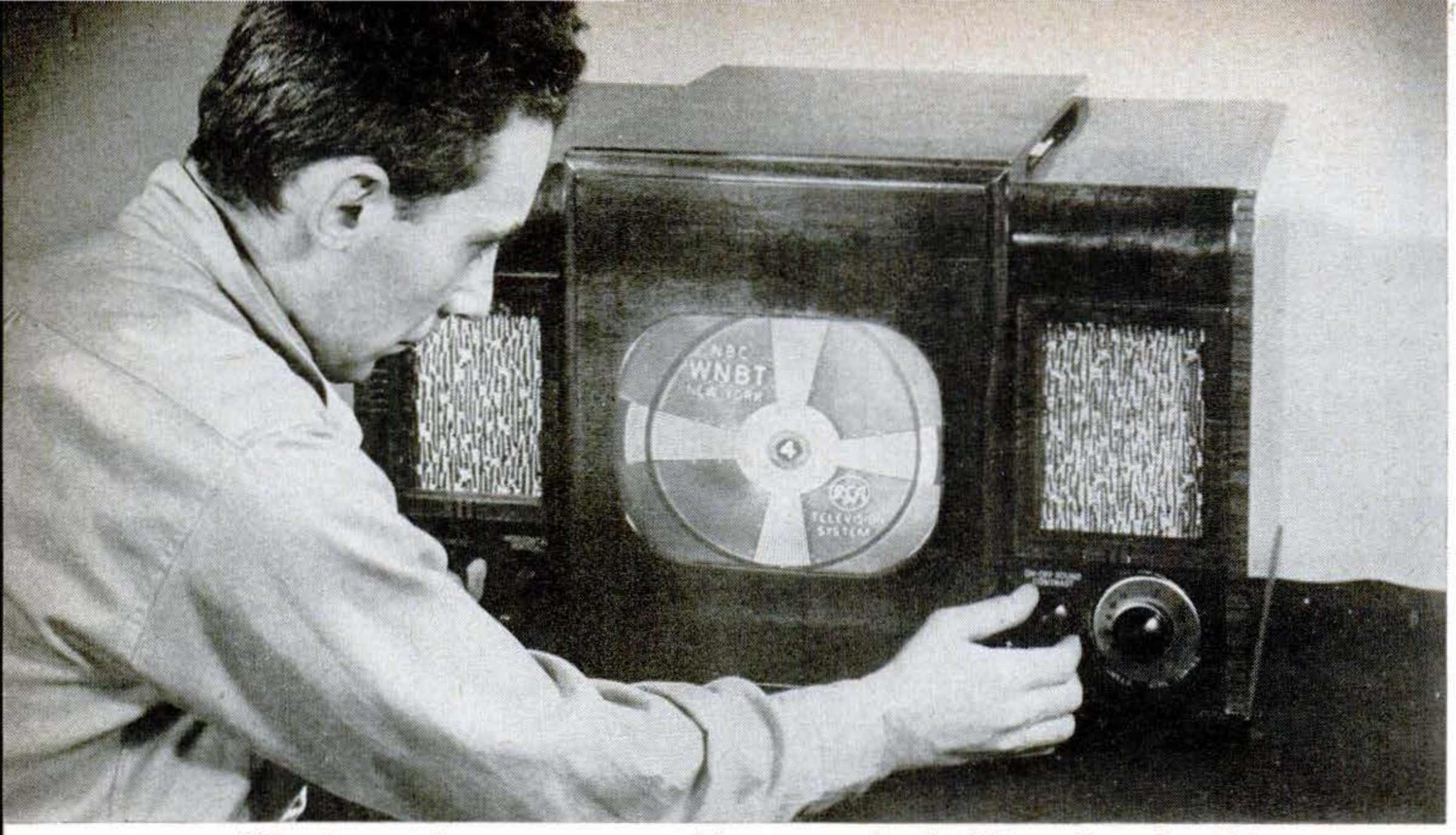

Fifty hours, from carton to cabinet, was the building time for this set.

I Assembled My Own TV Set from a Kit

You don't have to be an expert to wire up a television kit, but knowing a little about radio is a big help.

By Robert Gorman
PS photos by Hubert Luckett

LIKE everybody, I had been hearing about TV kits. I've spoken to people who have built them and asked lots of questions. Adding up the answers, it seemed to me that one man's experience cancelled out another's. "Anyone can wire up a kit," said some. Others cautioned, "Don't try it unless you know some electrons by their first name."

"How are the instructions?" I asked. "They're a cinch," I was told, "if you're a graduate engineer with radar experience." But the other side also had its say: "The diagrams are clear. You can understand them even if you don't know the difference between a 1-meg. pot and a drip pan for grid leaks."

The only sure fact I had to go on was that in every case that came to my attention the kit builder was either an expert radioman, or he had an expert standing at his elbow.

I'm no expert. I've built a couple of simple receivers and phono amplifiers. I know how to read diagrams, and because I can count from one to eight I can distinguish the prong connections on a tube socket.

I assembled a TV kit. It works fine.

When I decided to try TV kit building, my first problem was to select the kit. Conceivably I could have made a study of the different types on the market, but a comparison of their fine points would have put a strain on my technical knowledge. I had heard good reports on the RCA 630 TS receiver—a 30-tube job—so arbitrarily I fixed on one of the kits embodying this circuit. There are several such kits, so I had to be arbitrary again. I picked the one that was then the lowest in price and had the most parts mounted. It's the RCA-type kit marketed by Lafayette-Concord Radio, a large mail-order supplier. Complete with all tubes including a 10″ picture tube, it sold for $195.50. A cabinet to house it is also available for $42.50.

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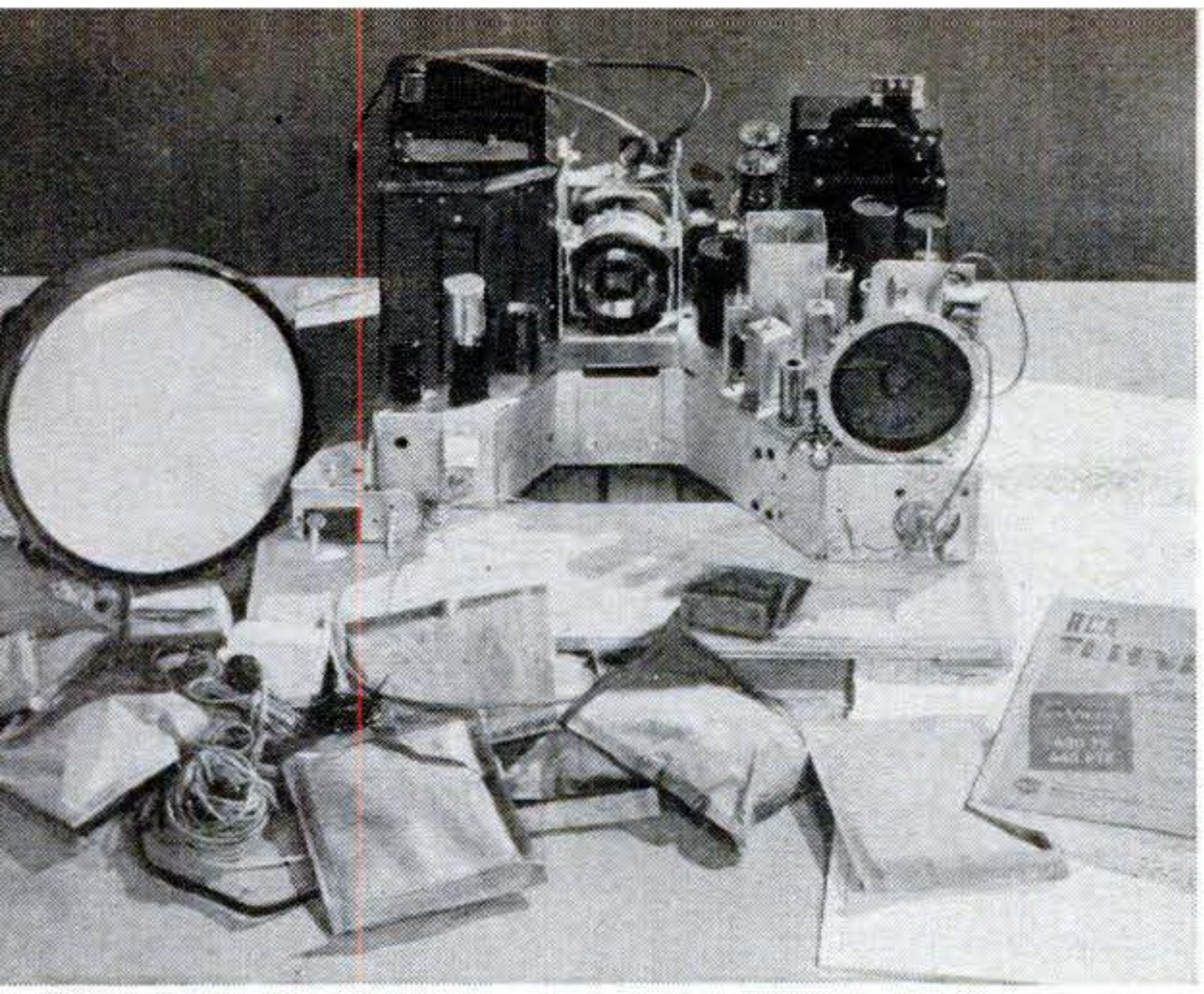
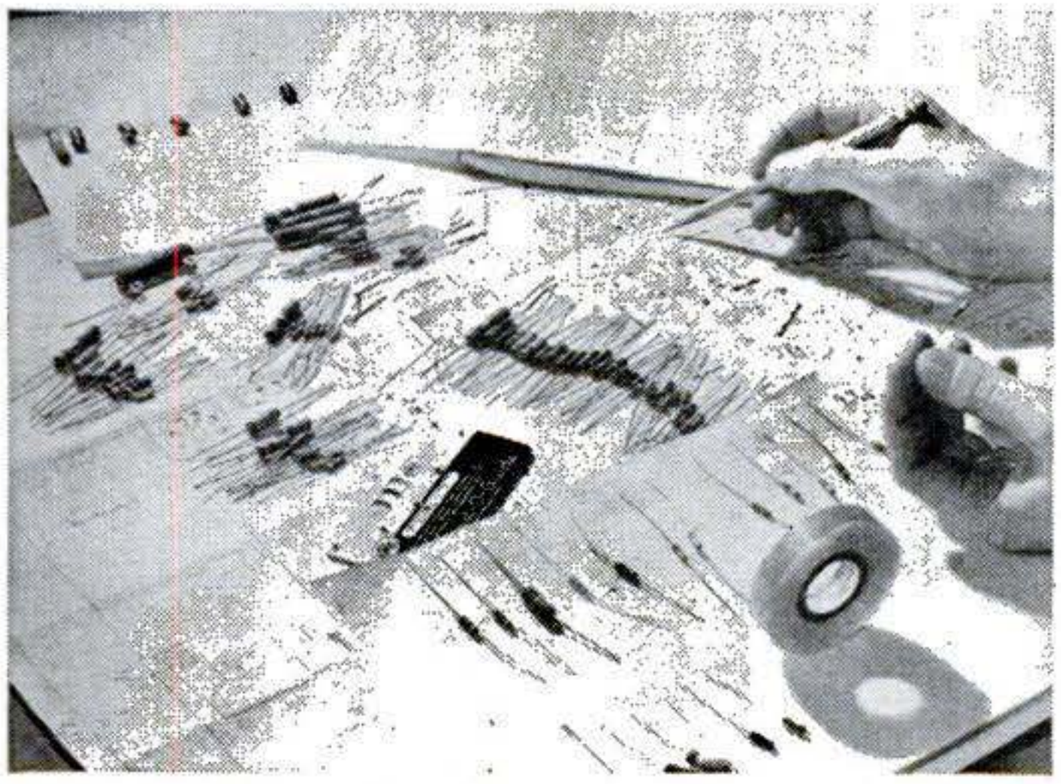


1. Here's the kit unpacked from its cartons. There are a lot of loose parts despite the fact that all the major ones are mounted.

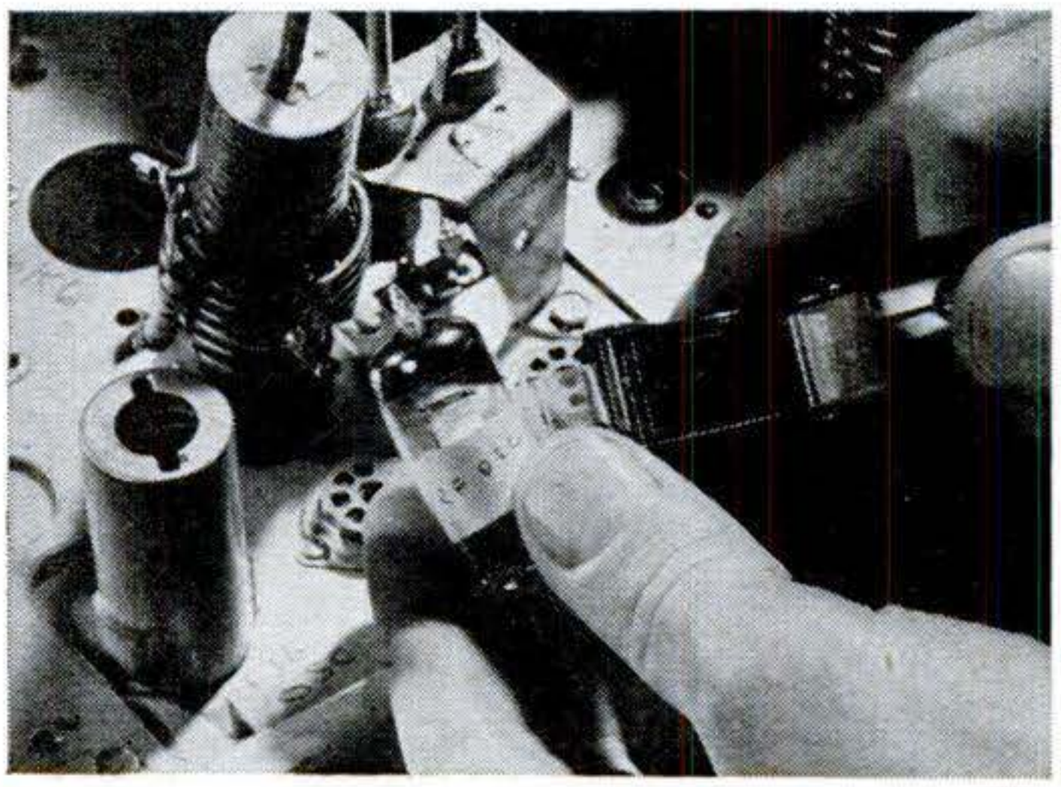
2. Emptying the envelopes shown at the left reveals this bewildering array. There are 108 resistors, 77 capacitors, and 11 coils.

As I tumbled the parts and packages you see in photo 1 out of the shipping cartons I couldn't help feeling how nice it would be to forget the whole thing. That feeling didn't diminish when I unpacked the eight or ten envelopes and got a look at the hundreds of resistors, capacitors, and coils, plus miscellaneous wires, knobs, hardware, and many mysterious parts. There's no organization of the components—they're all there, but separating the pieces and relating them to the circuit is the builder's job.

The instructions that are provided also give a minimum of orientation. You get an RCA service manual and a couple of mimeographed sheets of parts lists, color-code information, and instructions for connecting the prewired tuner section. Most

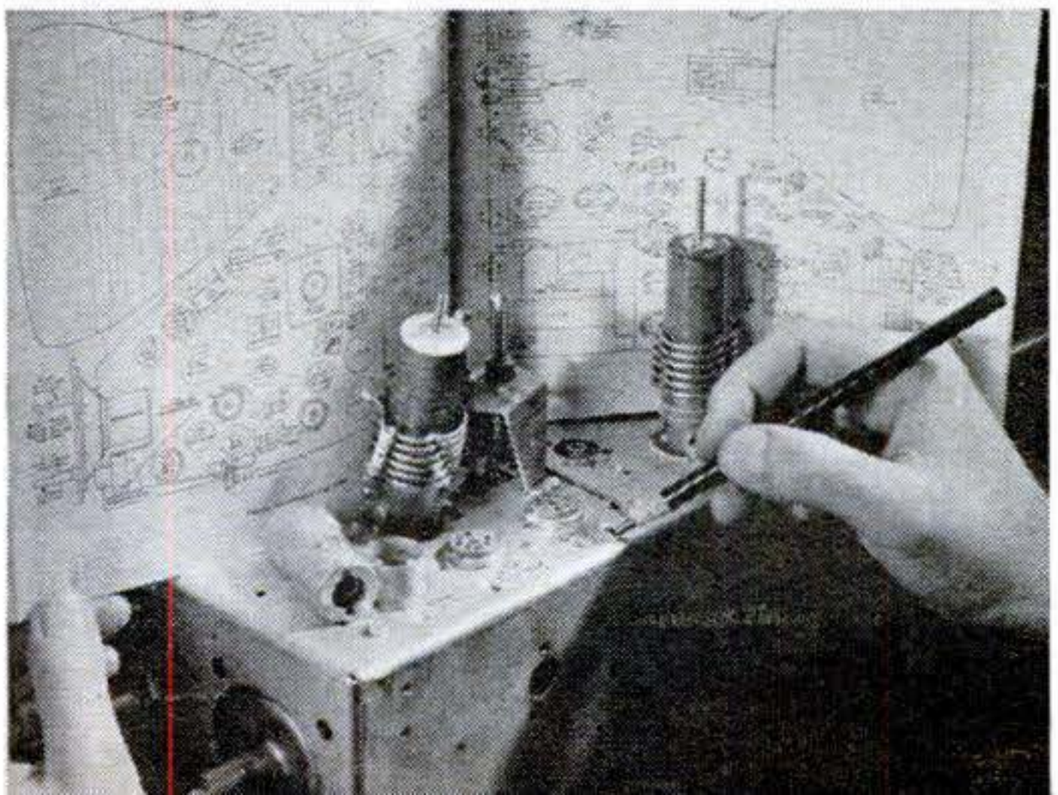


3. Organizing the items is a chore. I marked the value of each one on the diagram and taped the parts down in order on separate sheets.

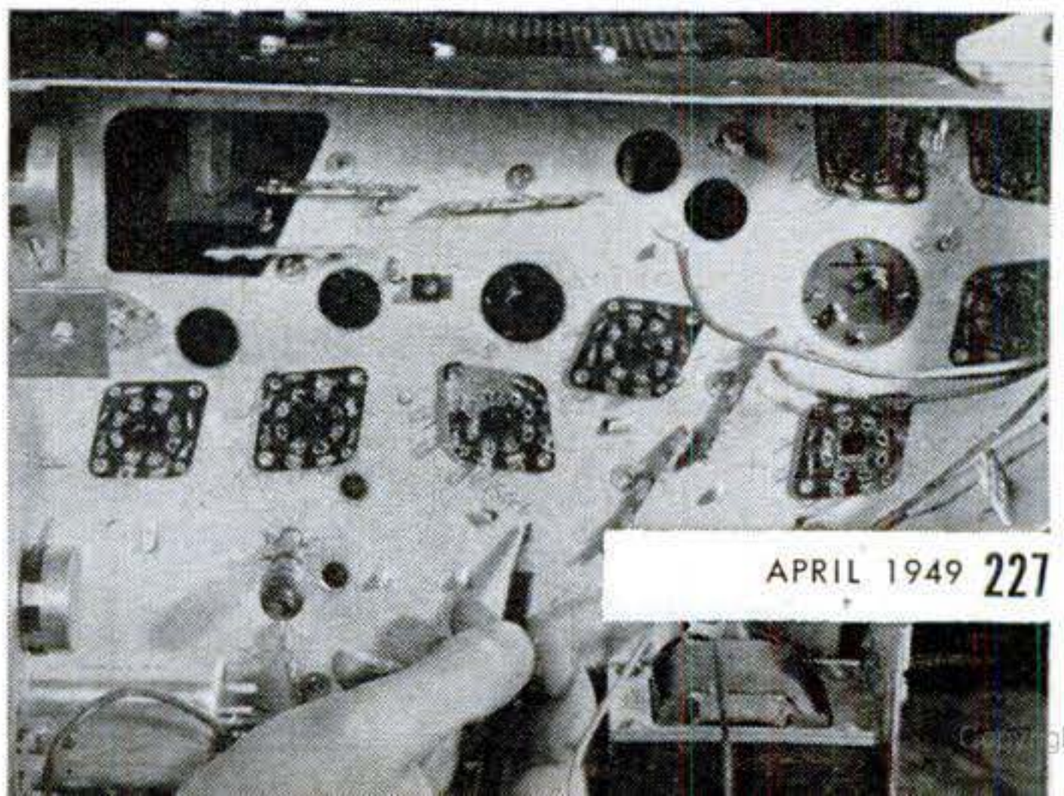


4. Removing the tubes isn't necessary, but I thought it was safer. In the tuner each must be marked for return to the identical socket.

5. Chassis layouts in the service manual give much useful information, including the function and location of each of the 30 tubes.



6. As an aid in wiring, I marked the parts on the underside of the chassis as well. It was helpful in locating terminals quickly.



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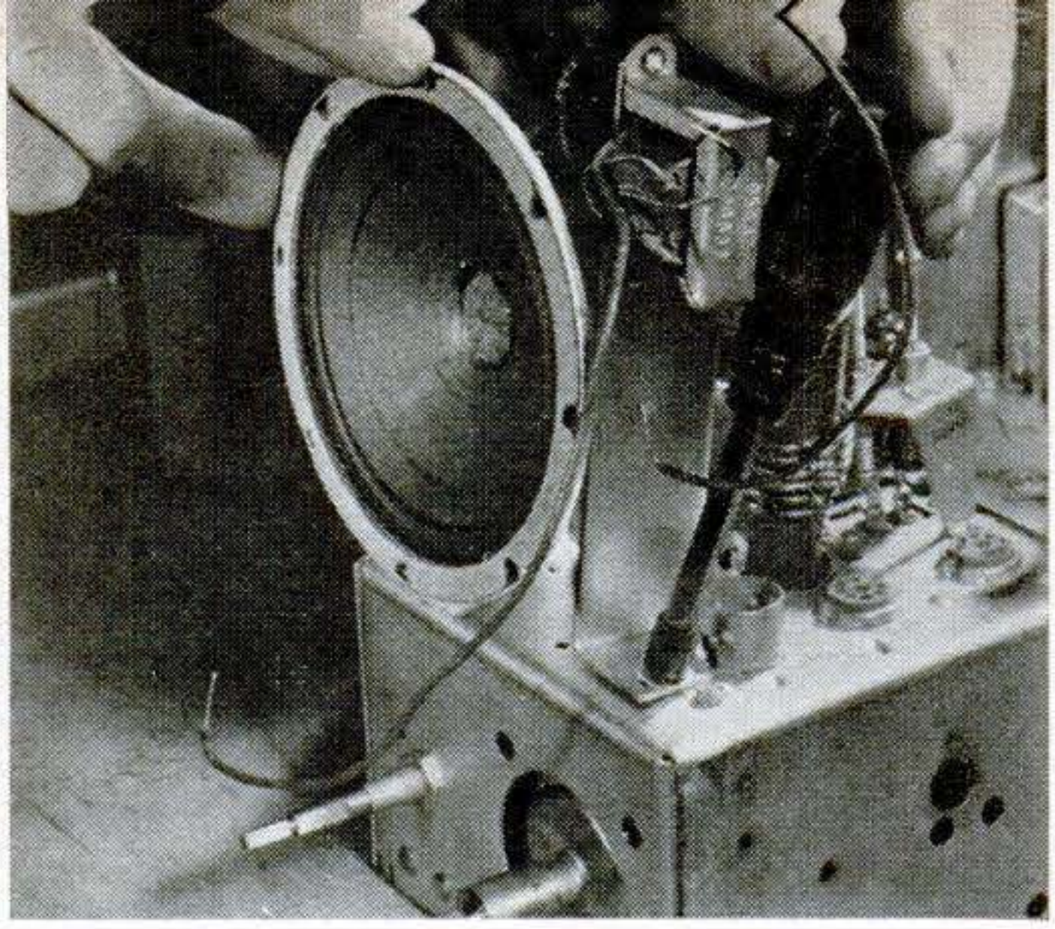
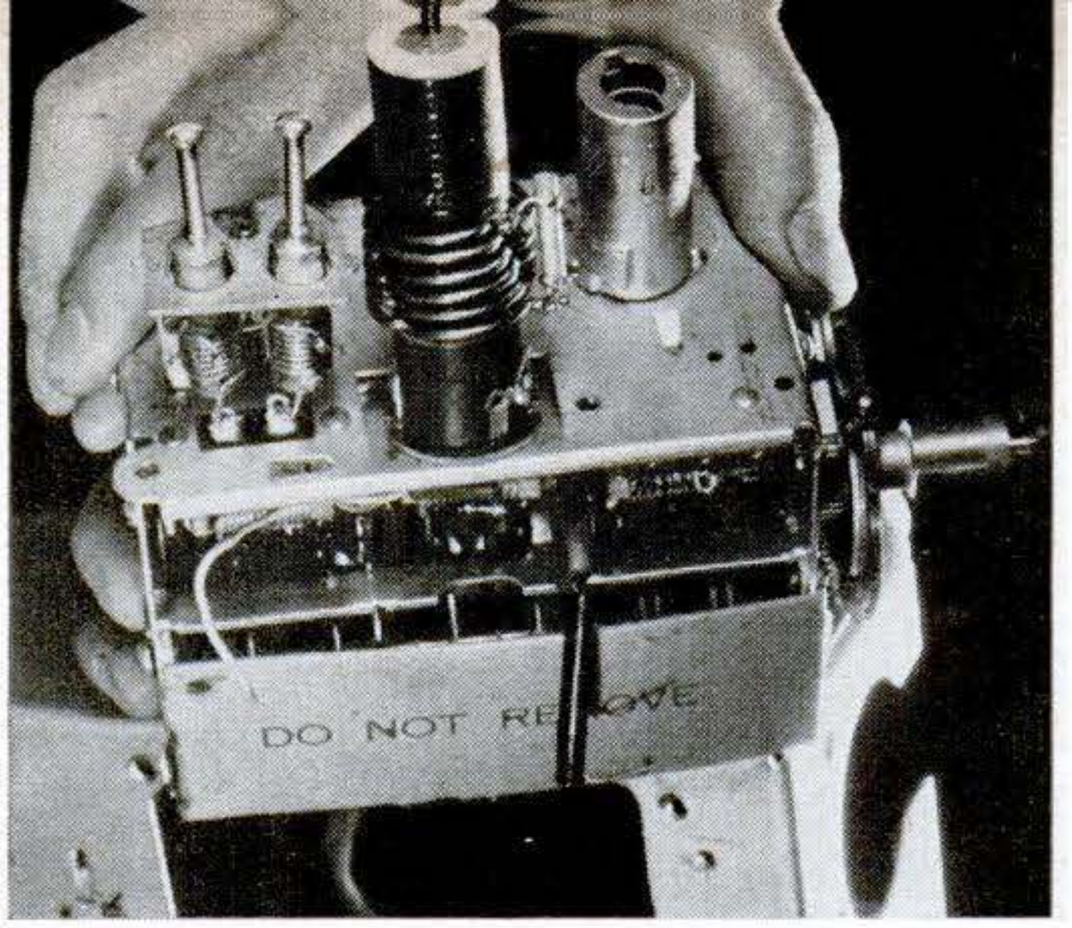
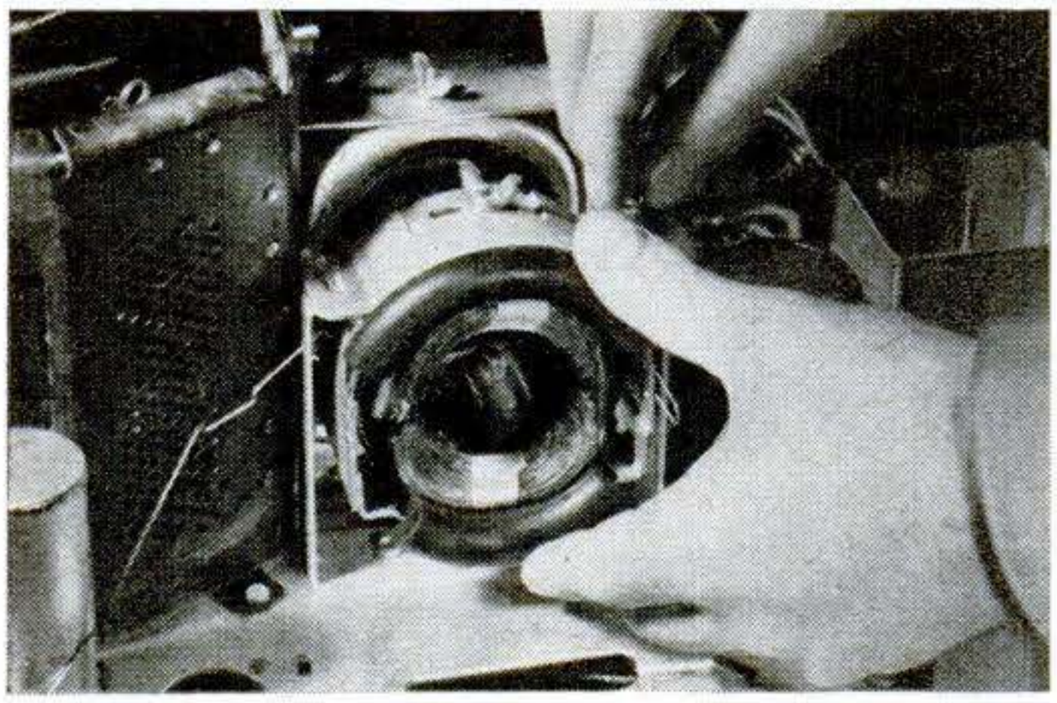


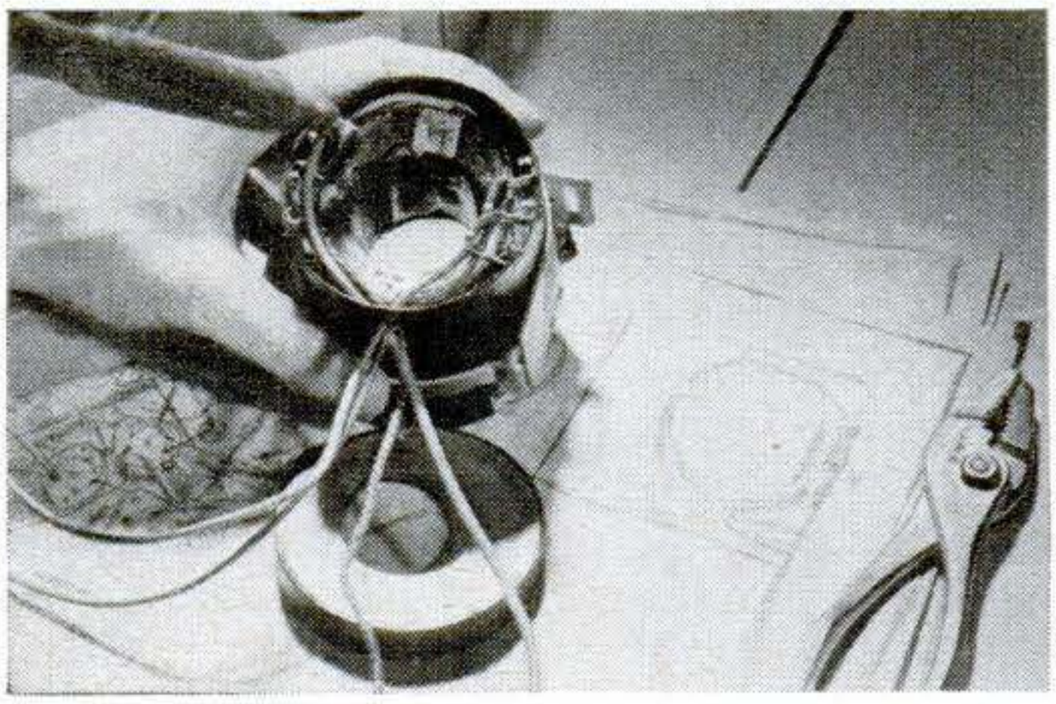
7. Speakers are fragile. This one has four leads which can be soldered in at the very end. I removed it for safety during the main job.



8. Do not remove is what it says, but I could not complete the wiring in this crowded corner without first unbolting the tuner.



9. The deflection yoke is held in a U-bracket by two wing bolts. They have to be taken out to complete internal wiring on the yoke.

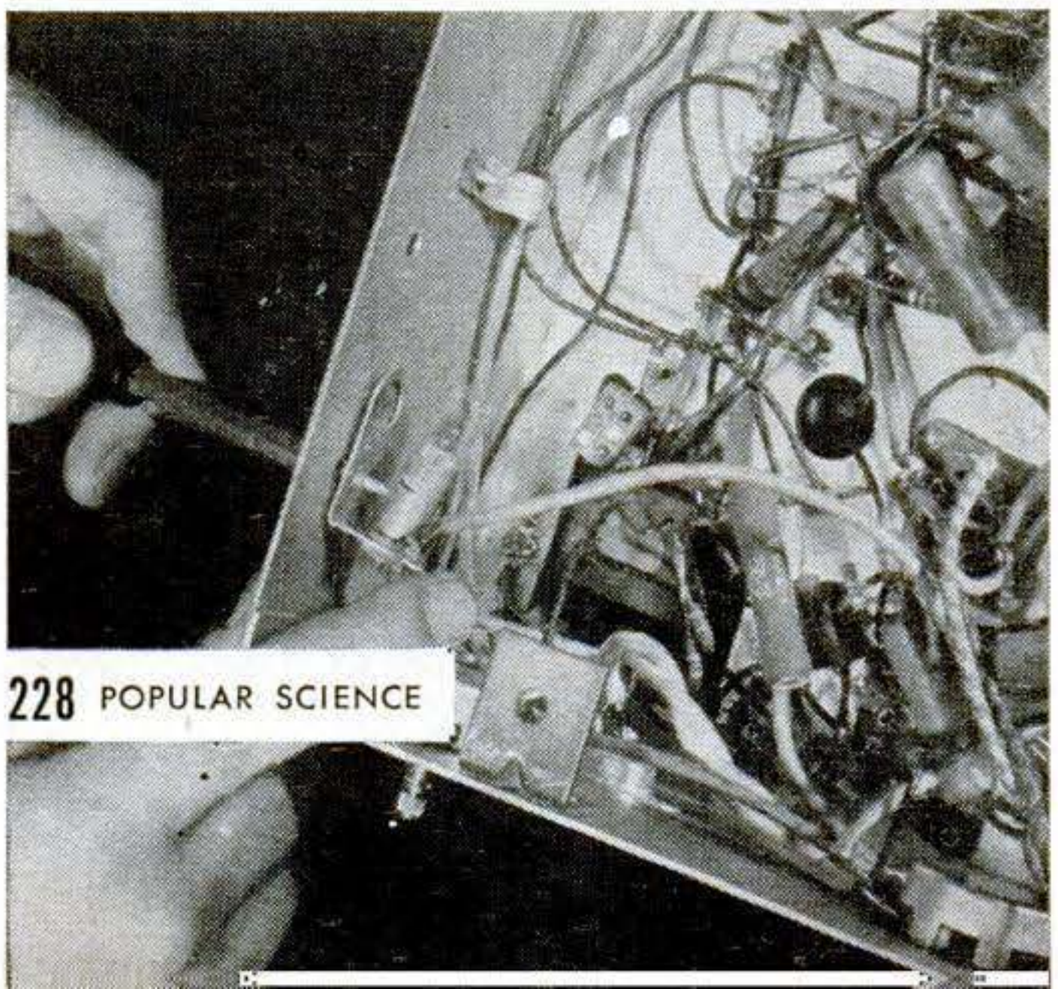


10. Two resistors, a condenser, and four wires are soldered into the back of the yoke. Details are furnished in a corner of the diagram.

important, there are six full-size pictorial diagrams showing the mounted parts in black and the wiring overprinted in red. Each of these sheets has a different set of connections, broken down for wiring convenience. Because of their size and the red overprinting, they are easy to read and follow. The RCA book has a good deal of additional information. I found a couple of minor changes from the RCA diagram; there are also one or two errors that had been corrected in pencil on the sheets.

By way of getting started, my first step was to arrange the small components according to wiring sheets. The experienced man may scoff at my system, but I found it helpful. I went through each diagram and the parts lists, marking the value of each part next to the code number printed in red. At the same time I picked out that part and taped it to a sheet of plain paper, marking the code number alongside it (photo 3). By first separating the resistors into piles according to the first band of color, I was able to pick out the proper one fairly quickly. For example, if I was looking for a 6,800-ohm resistor, I had only to glance through the pile containing those with blue bands, meanwhile looking for a gray second band, and so on. With the parts taped to sheets, I didn't have to hunt for a single piece while doing the actual wiring.

11. As a precaution against burning out the high-voltage transformer should one tube go bad, I wired in a No. 47 pilot light as a fuse.



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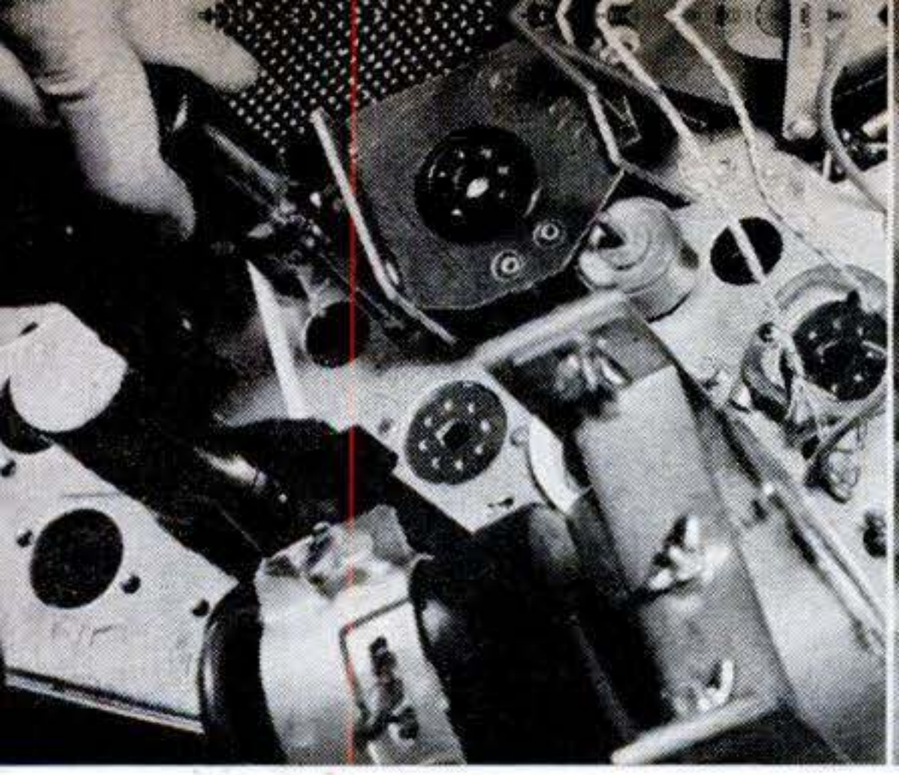
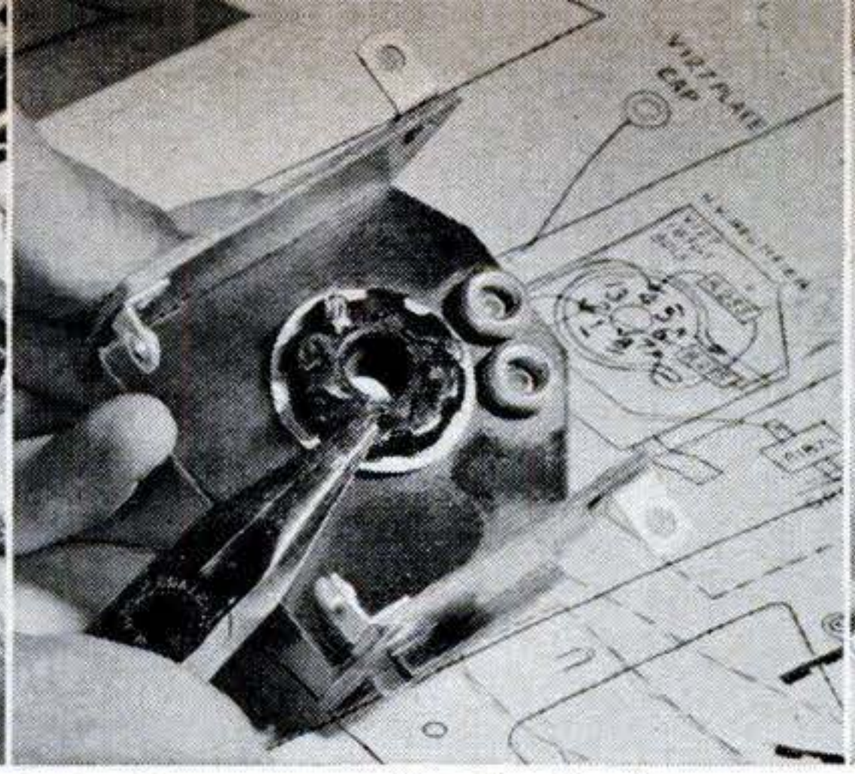
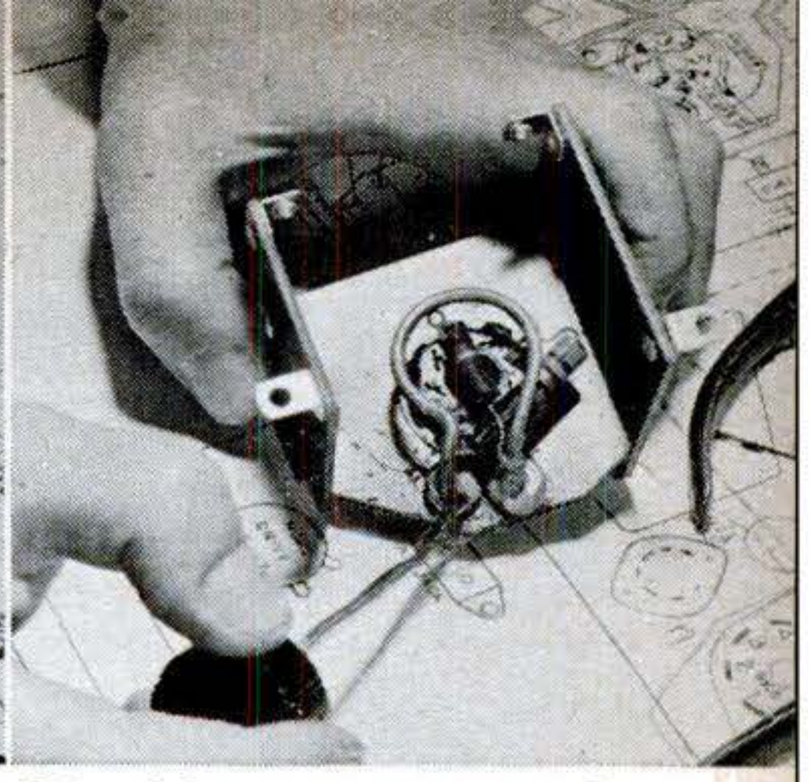


12. The high-voltage rectifier is placed on an insulated platform inside a shielded compartment. Remove the platform to wire the socket.



13. Corona—a kind of electron halo that occurs at high voltages—is minimized by removing the unused rectifier-socket prongs. One twist and they drop out.



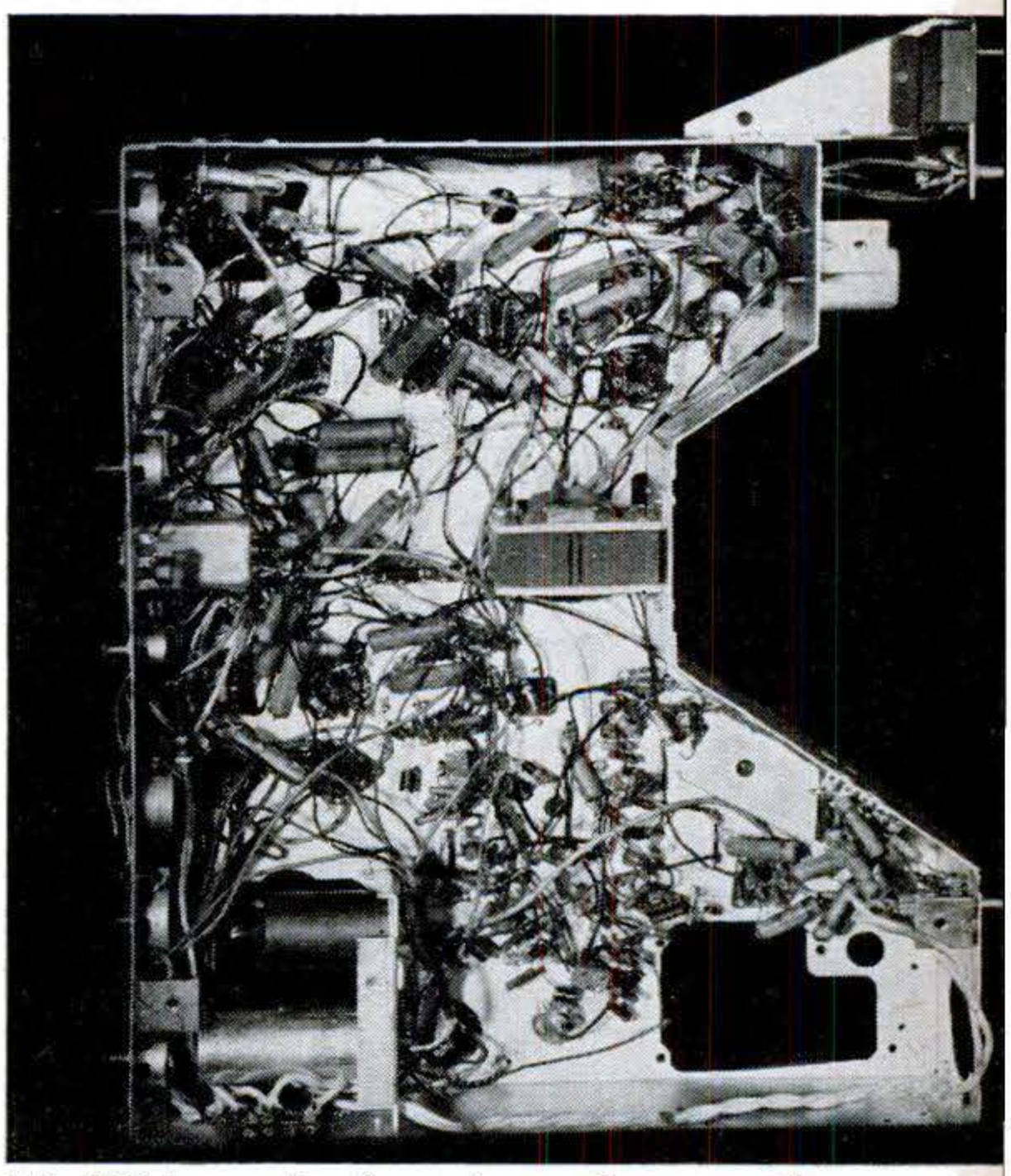
14. After mounting the parts and soldering in the corona ring, I dabbed the terminals with cellulose cement for extra insulation.

To minimize the risk of breakage in handling the cumbersome chassis, I removed all the tubes. A band of transparent tape over the number on the glass insured against it rubbing off in handling. The front end or tuner section, which comes completely wired and aligned, uses three 6J6 miniatures. It's essential that each tube be restored to its original socket. Photos 4 and 5 show how I marked each tube and socket with precise identification.

With these preliminary details attended to, I just had to buckle down to the serious business of wiring the chassis and soldering in a couple of hundred loose pieces. On this subject, too, I had heard all sorts of conflicting reports. The best time estimate I got was eight hours, but most of the people who quoted this figure had it at second hand. Reliably and at first hand I got approximately this time from two people—both experts who had wired a number of kits. One of them had a helper read off the diagrams while he worked.

However fast others may be, I have to report that my wiring time exceeded four times the estimated eight hours. I'll tip my hat twice to anyone who builds his first kit, alone, between sunup and sunup. There are about 400 pigtail leads to solder on the loose components alone, and another couple of hundred on the wiring and ground connections. Going strictly by the book, I tried clinching every lead before soldering it. That makes a big difference in time—the fast radiomen I spoke to didn't clinch the wires; they merely pasted them to the lugs with solder.

Incidentally, most of the lugs to which connections are made in the early sheets get additional leads in the later ones. On tube sockets it is therefore advisable to make the initial connections to the lower of the two holes, saving the top one in case another wire has to be brought to it. It's also important to keep leads as short as possible in any high-frequency radio work. I aimed at this but didn't succeed too well, as you can see in the close-up photos of my chassis. While we're on the subject of soldering, remember that rosin flux is conductive at high frequencies. If you decide to build a TV kit, use as little rosin as you can get away with and wash off any excess with alcohol. Rosin-core solder is okay; it eases the work



15. Wiring took a long time and was a tedious job. Professionals will scoff at these long leads. They should have been kept shorter.

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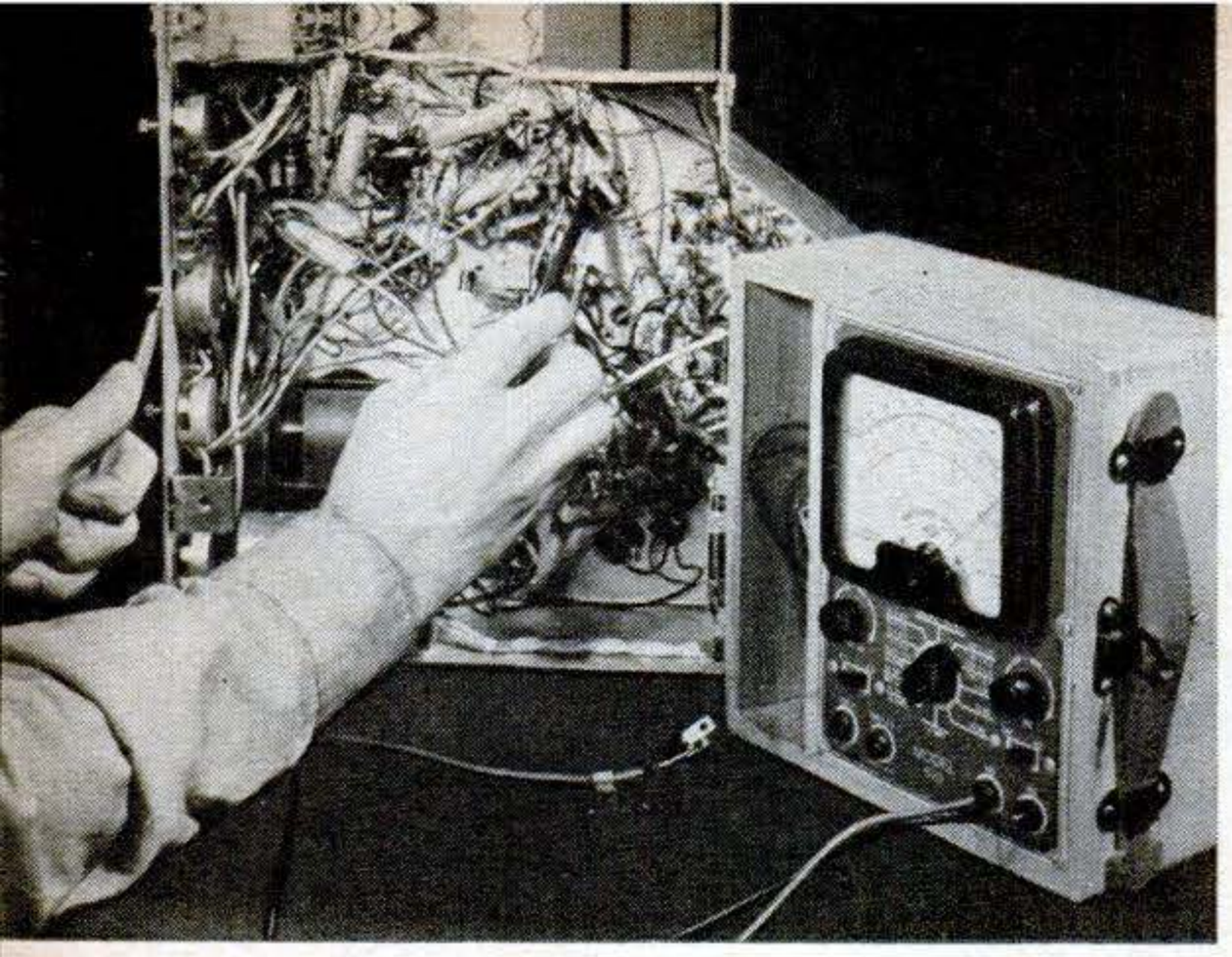
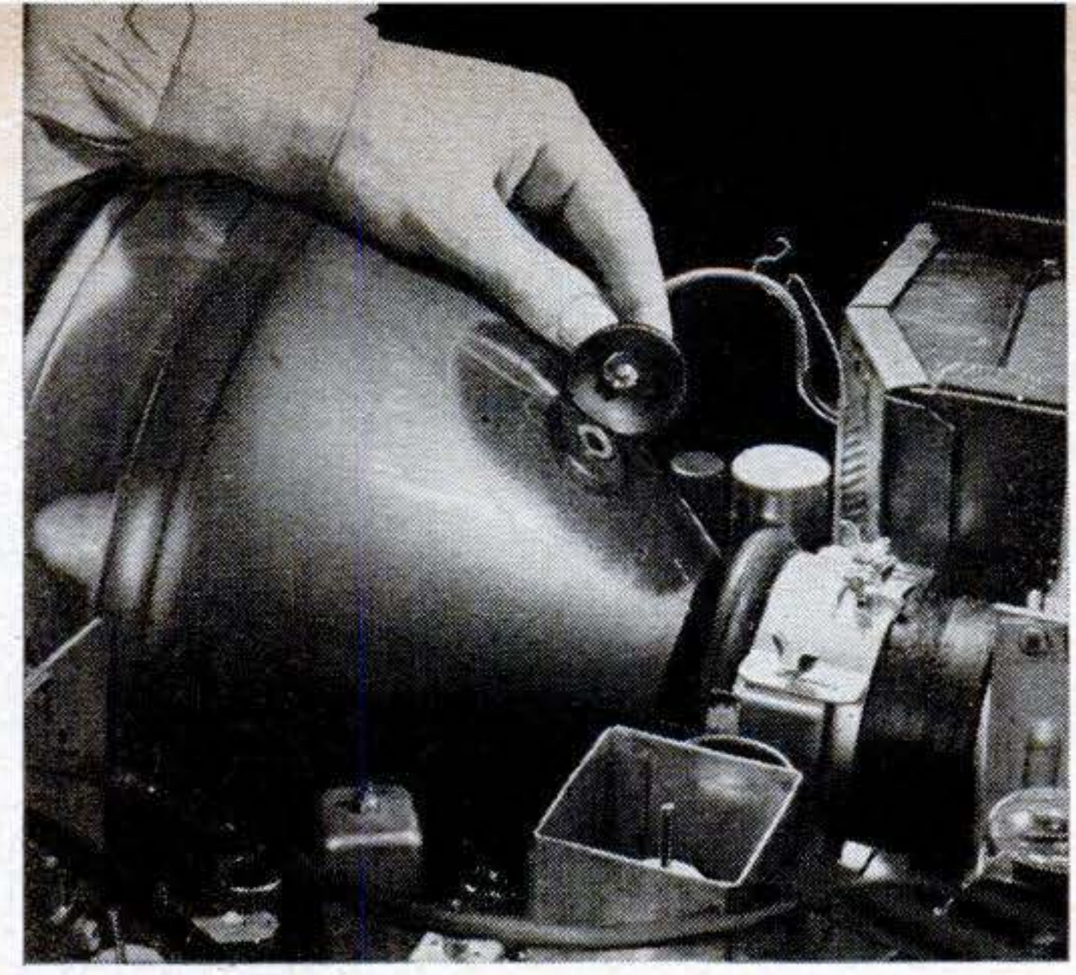
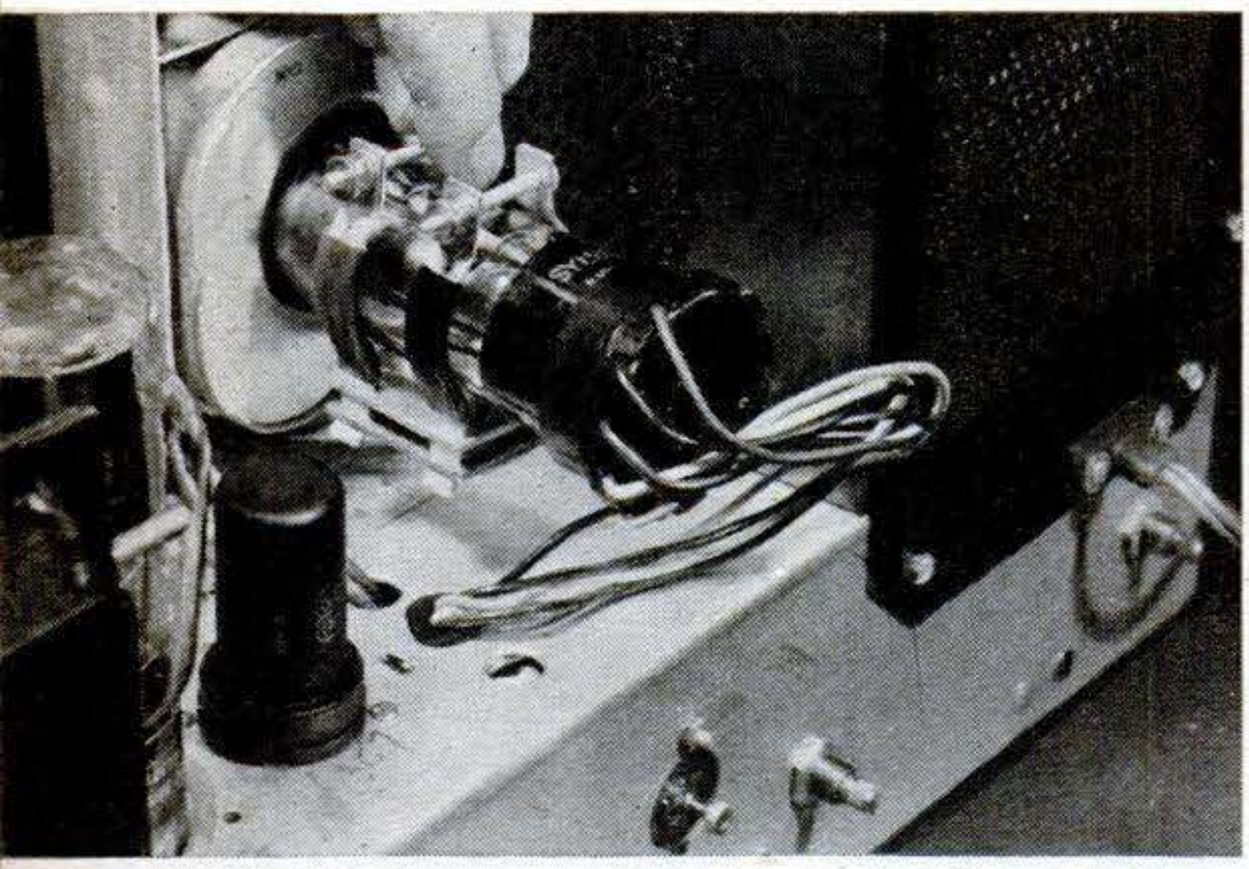


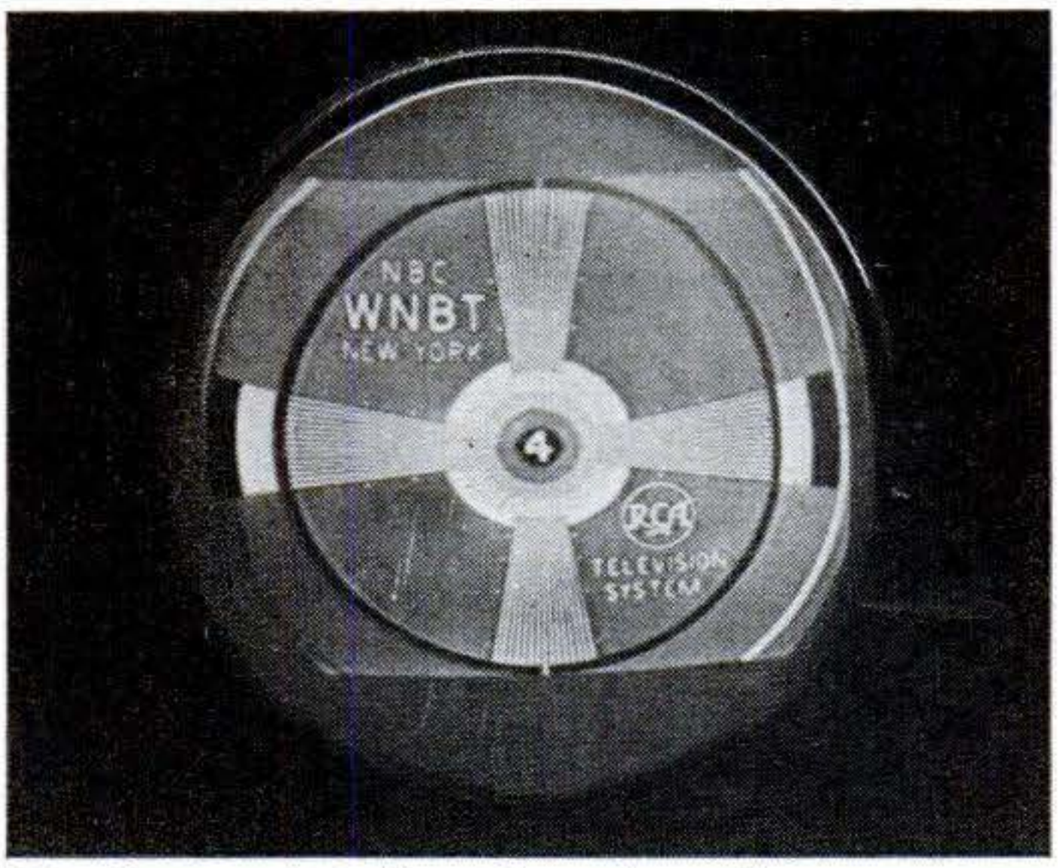
16. Checking for shorts is an important precaution. Test from B-plus to ground, AC to B-plus, and from both AC leads to ground.



17. Danger! 9,000 volts of it! The anode cap is the hot spot on top of the chassis. It holds a charge long after the power is turned off.



18. The ion trap on the neck of the tube is adjusted for brightness. Six other controls at the back are also set to get the best picture.



19. Success! A lot of work and worry went into assembling this kit, but that clear, sharp test pattern made it all seem worth while.

and doesn't contain enough paste to do much harm. No shielded wire is needed in the hookup. I started with a full-size 100-watt soldering iron. Along about the middle, as the chassis started to crowd up, I switched to a pencil-size iron and used it almost exclusively in the tight corners.

The deflection yoke through which the neck of the picture tube passes has to be removed from the top of the chassis. Two wing bolts are all that hold it. The back, which is a cardboard cover, slips off so that two resistors, a condenser, and four wires may be soldered in.

Discussing the construction of this kit with some men who know it well, I picked up a couple of tips that may be worth passing along. Servicemen have encountered some trouble with sets and kits of this type because the 6BG6-G horizontal-sweep output tube sometimes becomes defective and starts to draw excessive current. Since the plate of the tube is in series with one winding of the high-voltage transformer, the extra current also flows through the transformer. In most cases this results in a burnt-out transformer—and an expensive repair job. To reduce this hazard, I inserted a No. 47 pilot light in series with the transformer lead to act as a fuse. Photo 11 shows how I attached the bracket beneath the chassis. The lead from terminal 1 on the transformer to pin 6 (a dummy pin) on the 6K6-GT horizontal sweep oscillator is opened and the lamp wired in. Excess current burns out the bulb.

Another useful trick—although less generally known and applied—concerns the mounting of the 1B3/8016 high-voltage rectifier. This tube puts out better than 9,000 volts. As a result, the socket connections around the base are subject to a high-voltage discharge known as "corona." One method of minimizing corona is to remove

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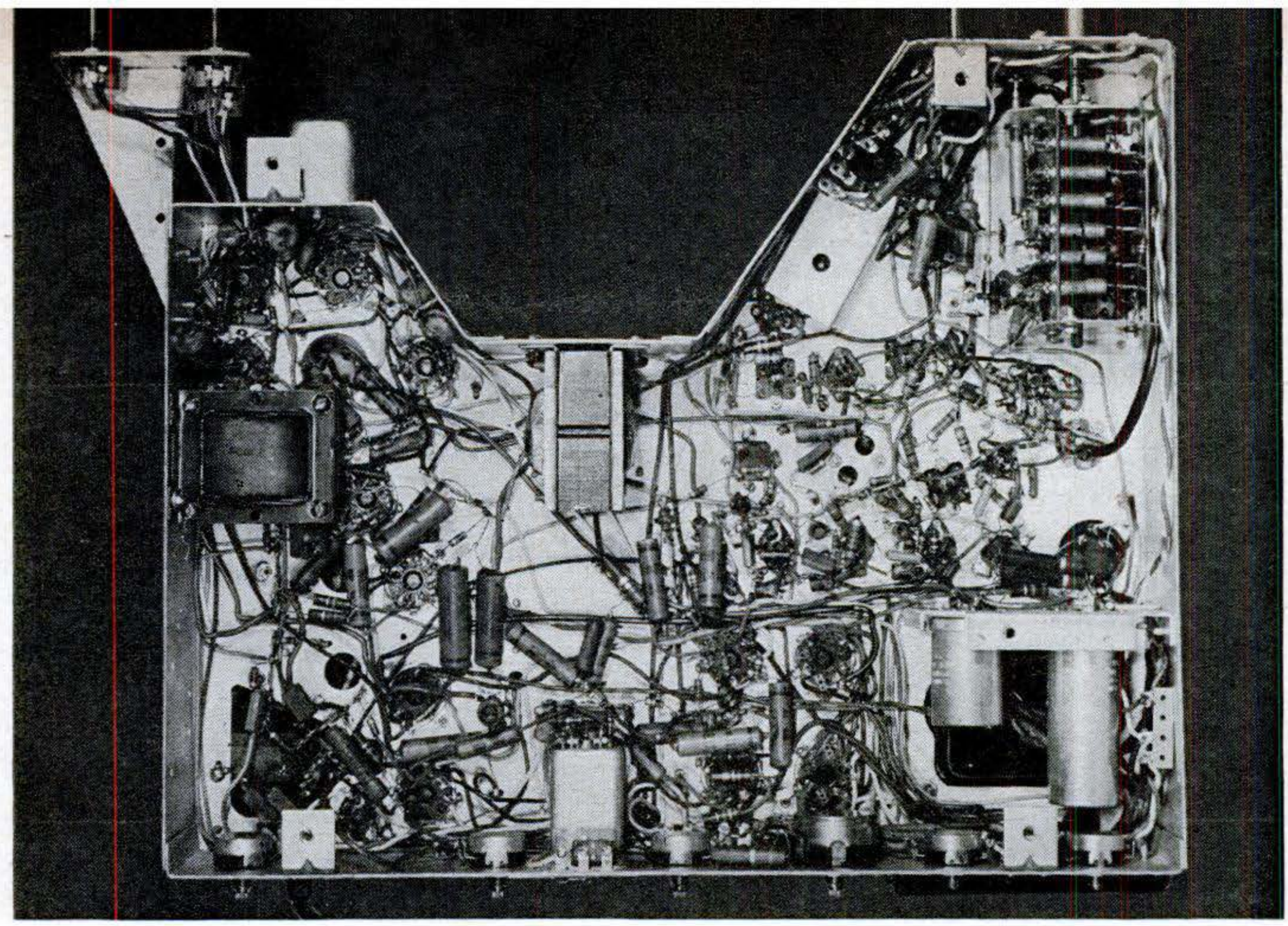

20. This isn't my set. I wish it were, not because it works better than mine but because I'd be proud of the wiring. It was assembled by Melvin Pollack, Lafayette's chief service engineer. Note short, neatly dressed leads and compact arrangement of small parts.

the extra lugs from the bottom of the tube socket. Only three of them are needed, so the others can be twisted slightly and pushed out through the top of the socket (photo 13). The necessary parts and wires are then soldered in, and the corona ring is sweated into the two anchor points on the mounting plate. Excess solder and rosin is scraped out and the anchor lugs are coated with cellulose cement.

When I finally finished the wiring I had to agree with the most enthusiastic kit builders. It's not hard. It was, for me, a long and tiring job, but it's certainly possible for a semiskilled experimenter to get it done.

After checking the wiring carefully, I made a couple of safety tests before plugging in the set. To check for shorts you need an ohmmeter (photo 16) or a continuity tester. The main points to test are B-plus shorts (touching one meter prod to the chassis and the other to two or three electrolytic-capacitor terminals), shorts from AC to ground, and from AC to B-plus. If you get no reading at these points, it is reasonably safe to plug in the set. It may not work, but the chances are that no serious trouble will result.

Handling the picture tube calls for special precautions. Hold it only by the large bulb, never by the neck, and don't try to move the set while the tube is in. When using the tube out of a cabinet, prop a medium-size book under the face end to support the weight (in a cabinet it is held by cushioned brackets). When the set is turned right side up and all the shields are in place, the main danger spot is the second anode cap (photo 17). There's over 9,000 volts there, so keep clear of it if you value your health. Make sure the power is off when handling the cap—but even that isn't enough. The high-voltage capacitors store a charge and can give you a jolt long after the switch is turned off. After removing the cap from the tube, hold it a half inch from some piece of grounded metal to draw a spark if any energy remains. Bring it closer until it touches the metal. Make sure that the cap is either in the tube or clear of any possible ground when the power is on.

The ion trap, being adjusted in photo 18, and the six controls along the rear edge of the chassis must be set for the best image. Once they are tuned for your antenna and location, nothing has to be done to them. All further tuning is done by the seven controls in front. END

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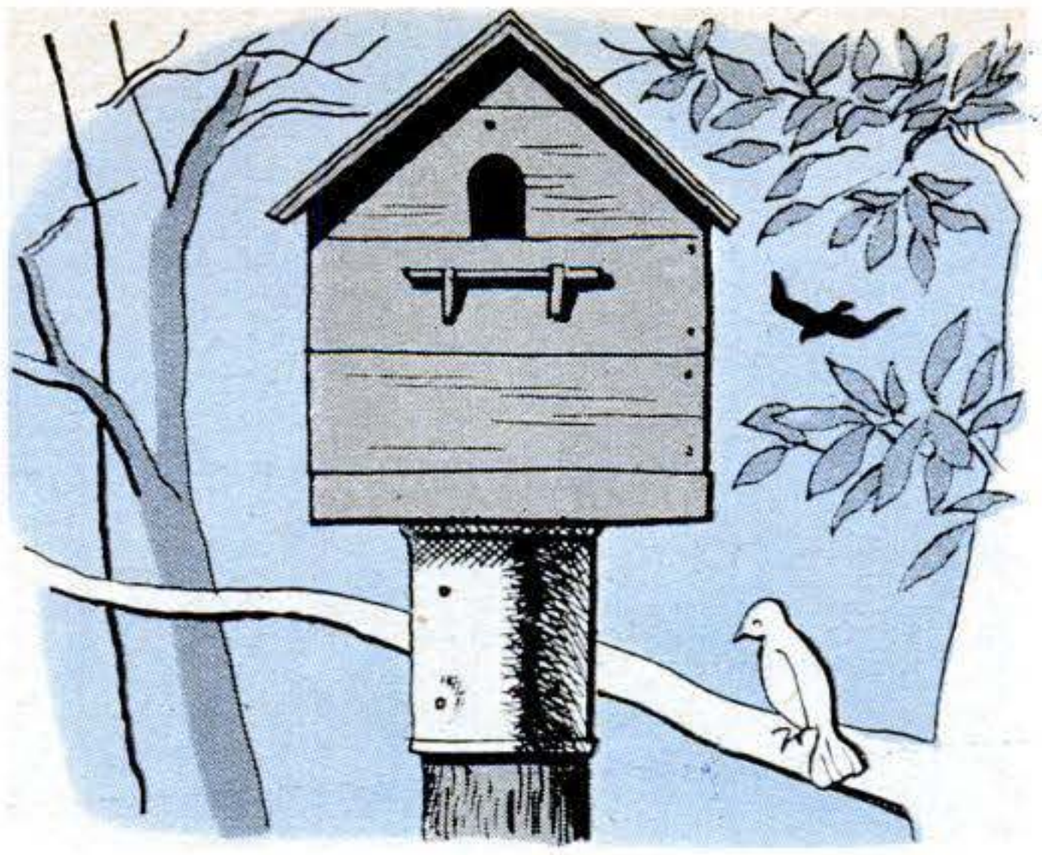
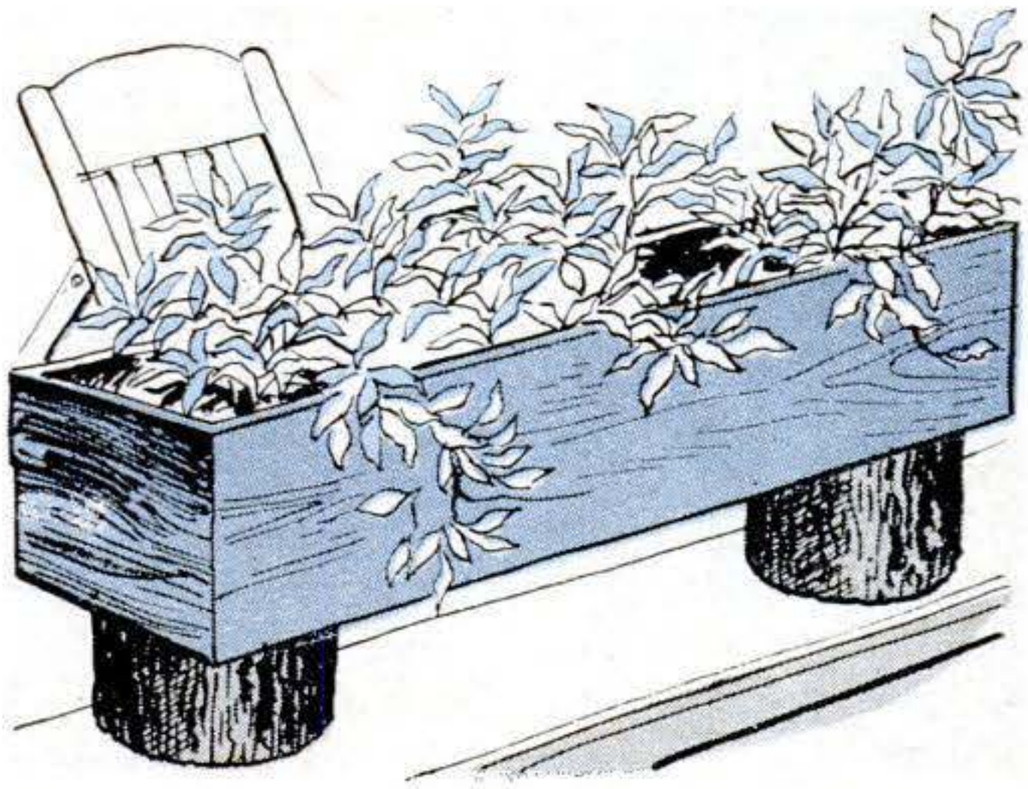
Keeping the Home Shipshape

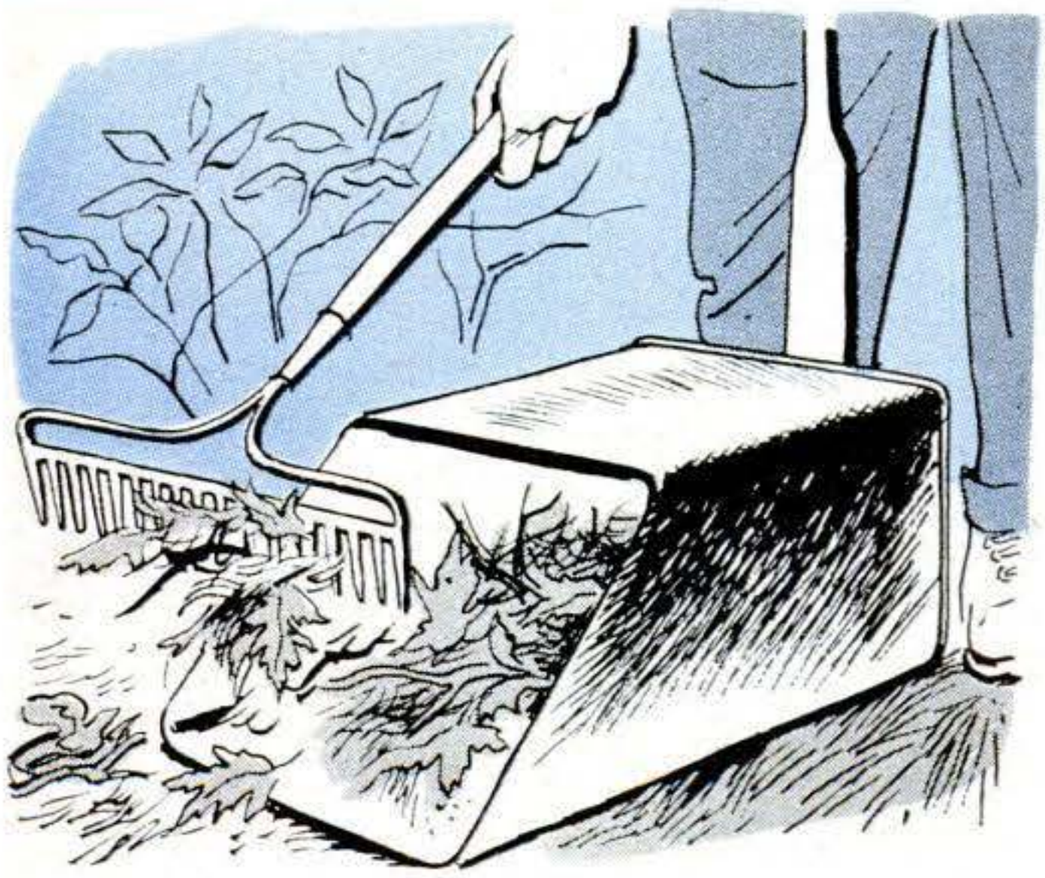
If a paint can has no handle, place it in a child's sand bucket. It will be much easier to carry up a ladder. You can also fit a hook to the handle of the pail for hanging it.



Birdhouses can be fastened to the top of a pole with a large tin can. Screw the house to the bottom of the can, slip the can on the top of the pole, and nail it in place.



To prevent rotting of porch railings by flower boxes, set them on two sections of a small log. Cut the sections about 6″ long, selecting pieces that are nicely covered with bark.



An old 5-gal. oil can is quickly converted to a no-stoop catch pan for the garden. Cut one end off diagonally with tin snips and fasten a handle to the other end with bolts.

Save wood shavings and scraps from your workshop in paper bags. Tie the necks tightly. Then, to build a fire in a stove or fireplace, just use one of these bags as kindling.

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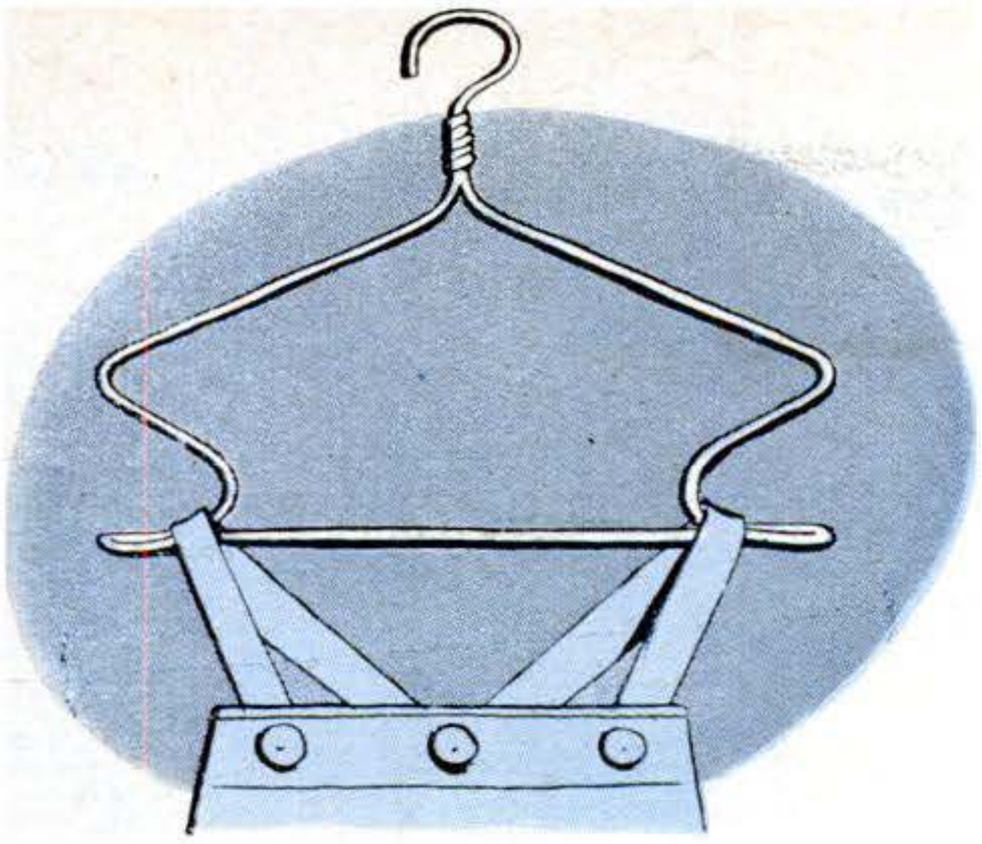
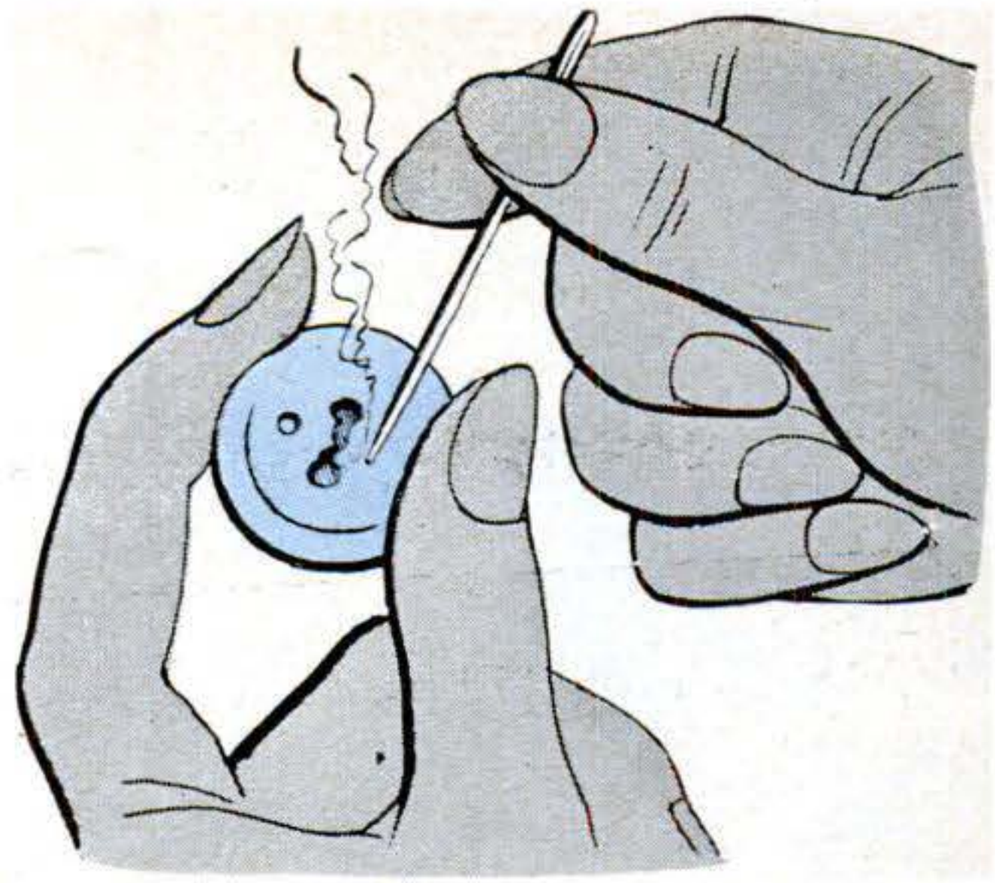
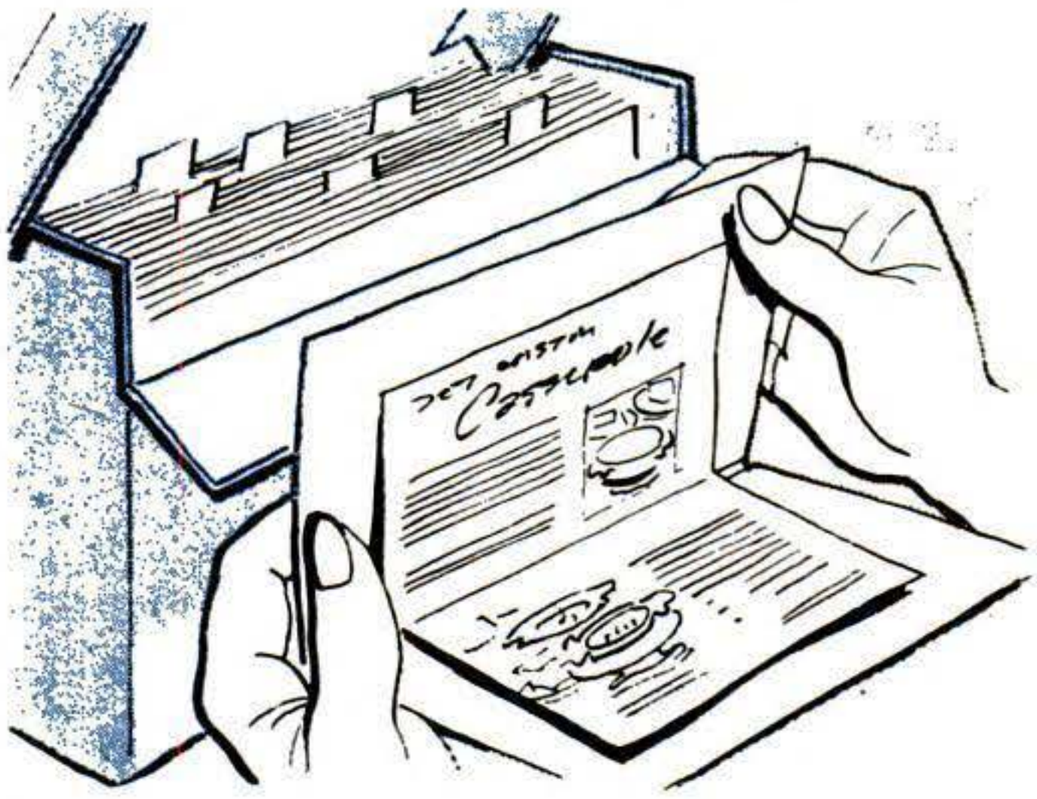


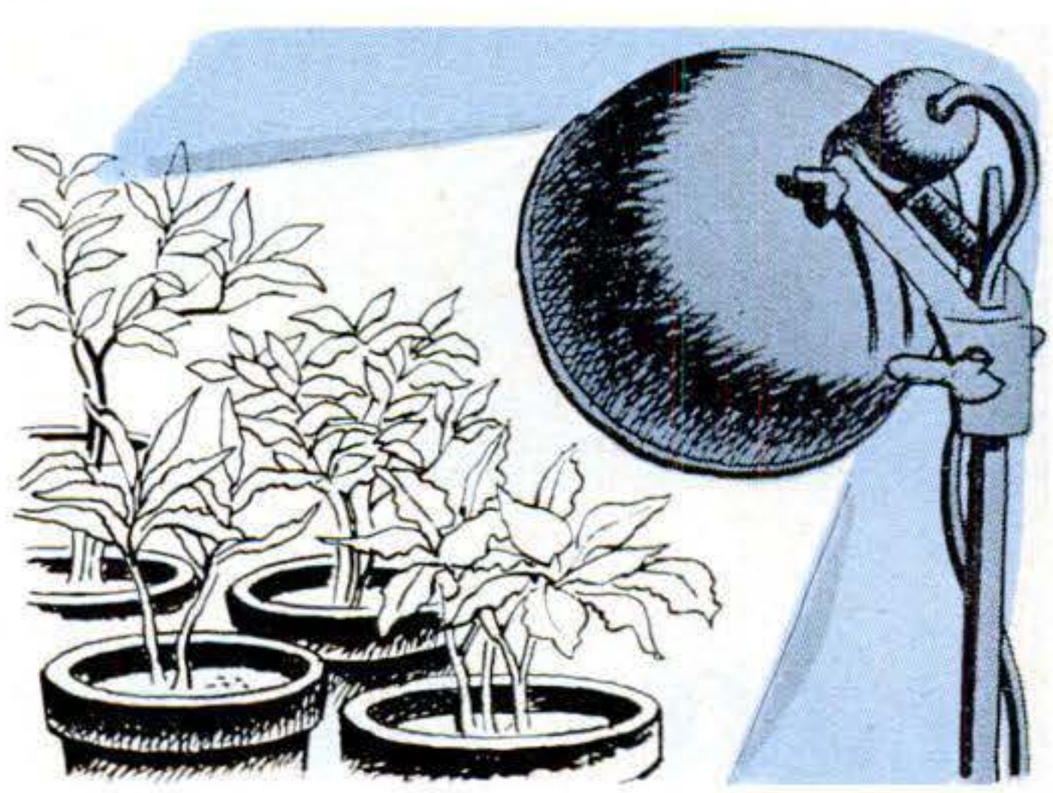
Bending inward the ends of standard wire coat hangers will convert them to holders for children's garments with suspender tops, such as sun suits, suspender skirts, or overalls.



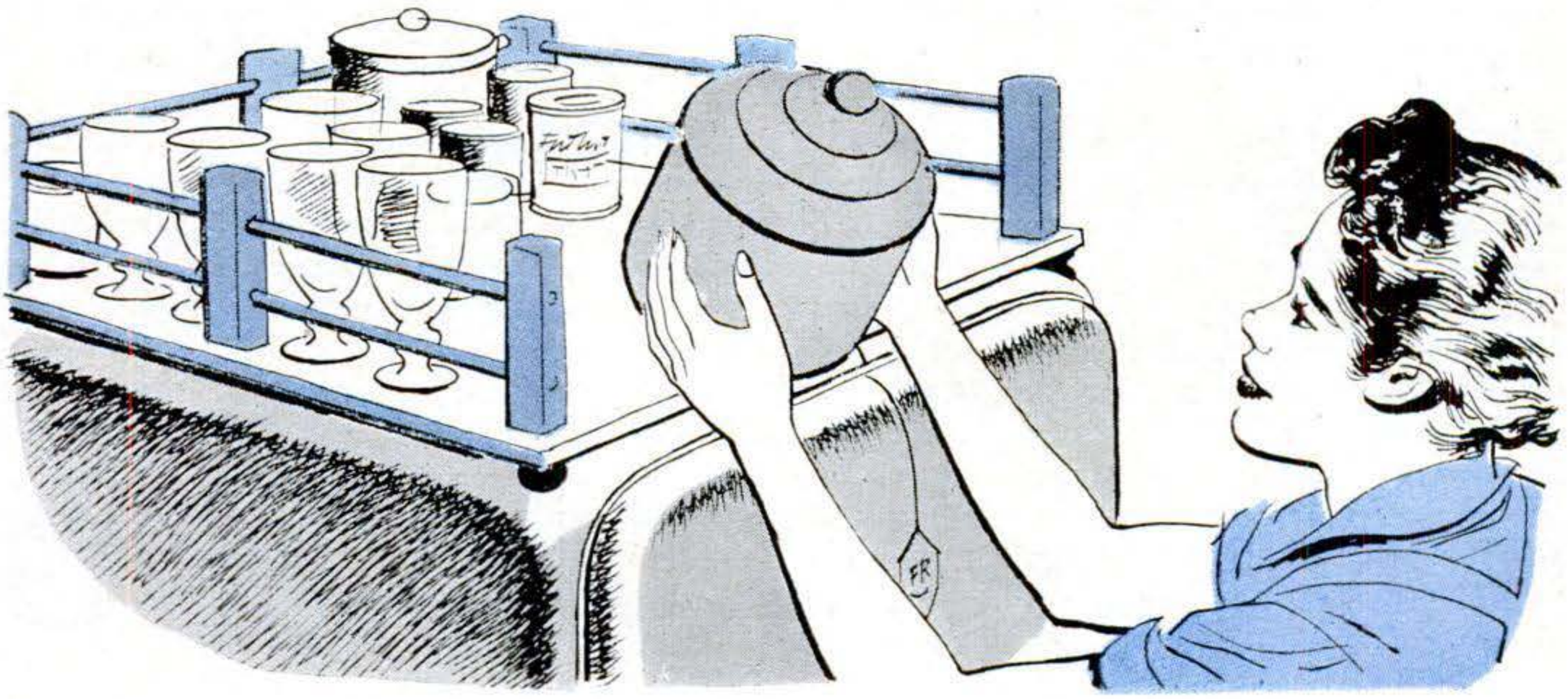
When the material between the holes of a plastic button gives way, you can repair it by piercing two new holes with a heated needle. This is handy when you can't replace a color.



Two 3" by 5" file cards, hinged with cellulose tape, form a neat folder for recipes clipped from magazines and newspapers. Paste the recipe to the cards and fold them together.



House plants that don't get much sunlight can be helped by turning a sunlamp on them for a little while each day. Don't place the lamp too close to them or leave it on too long.



The partially rounded tops of most refrigerators make them unsatisfactory for storage. A plywood sheet, held by suction cups and fenced with dowels, gives you a handy flat surface.

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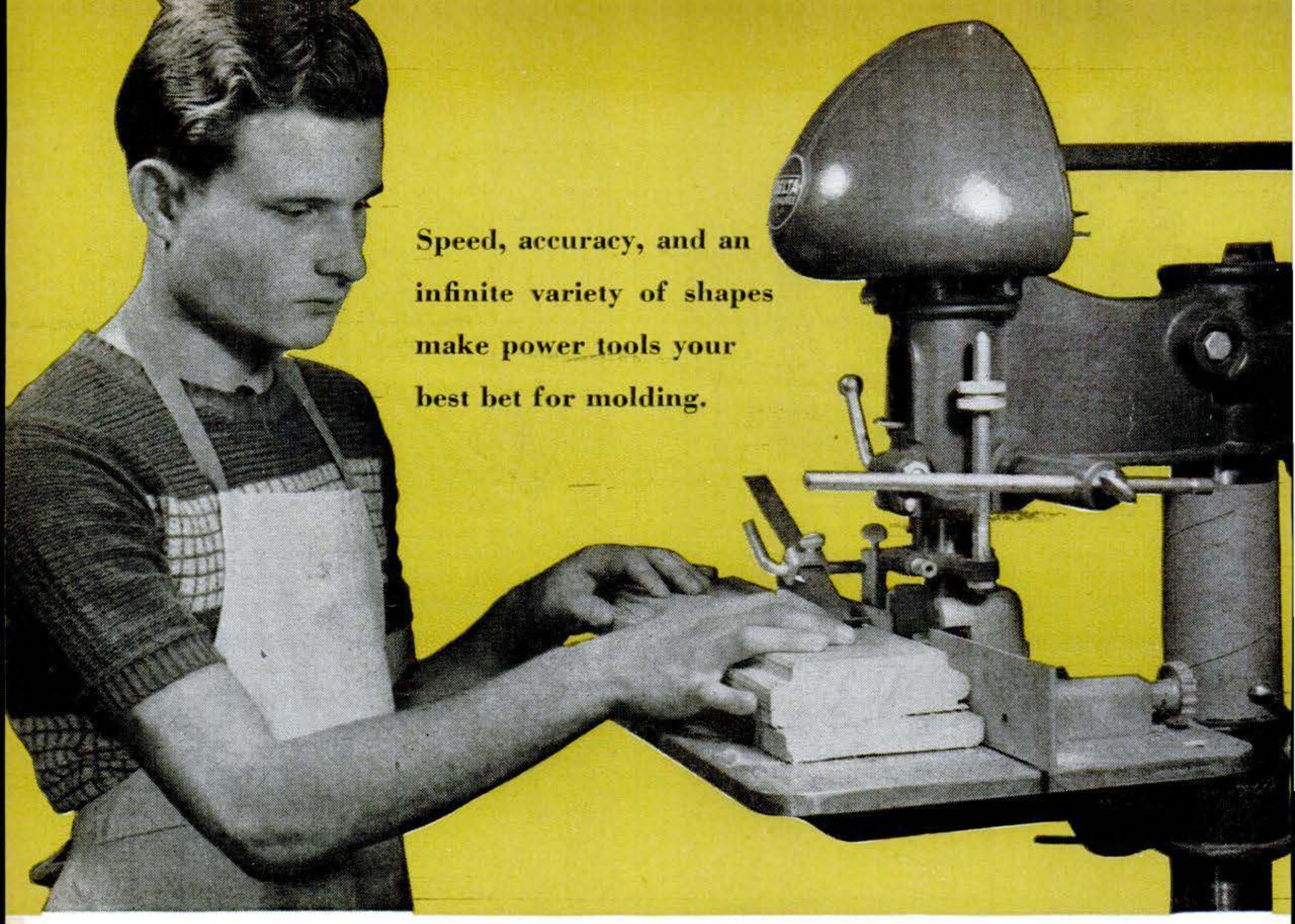

Machines Shape Moldings Quickly

By Edwin M. Love

THERE'S a lot of satisfaction in making moldings by hand, and such trim lends an authentic touch to the reproduction of period furniture. But granting this, don't overlook the advantage of machine work. A spindle shaper takes the place of experience. If you can push and pull, you can make a thousand varieties of molding with this tool, ornamenting straight edges, enriching circular table tops, and profiling all manner of scroll-sawed curves. Not only can all this be done at a gallop, but the precision of the finished job is incredible to those who aren't familiar with the shaper.

Though the shaper is specially adapted for molding, other power tools will also do the job. The drill press, for example, is just as effective if not quite as fast. You can also slip a special head on your circular saw to mold straight or convex edges, and you can shape modern stepped edges with a jointer. Add a little ingenuity to almost any power tool and you can do at least part of the work.

A shaper equipped with cutters similar to those illustrated in Fig. 1 gives a choice of several sizes of beads, flutes, quarter-rounds, and coves. These can be cut singly or in combinations, as pictured in Fig. 2. If you have had experience in jointing and rabbeting on a shaper, you'll have no trouble with moldings, since the adjustments of table and fence are essentially the same.

The molding being made in Fig. 3 has a

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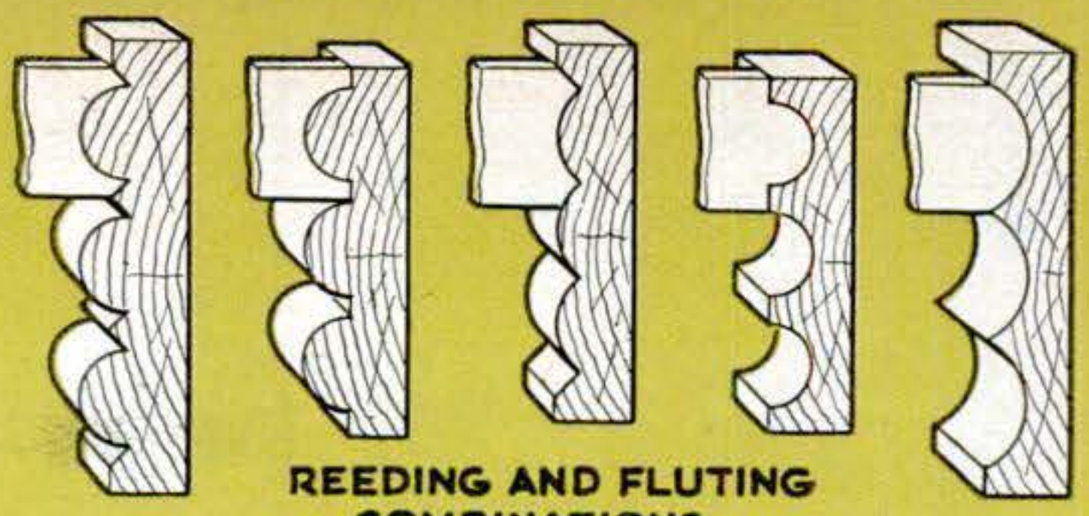
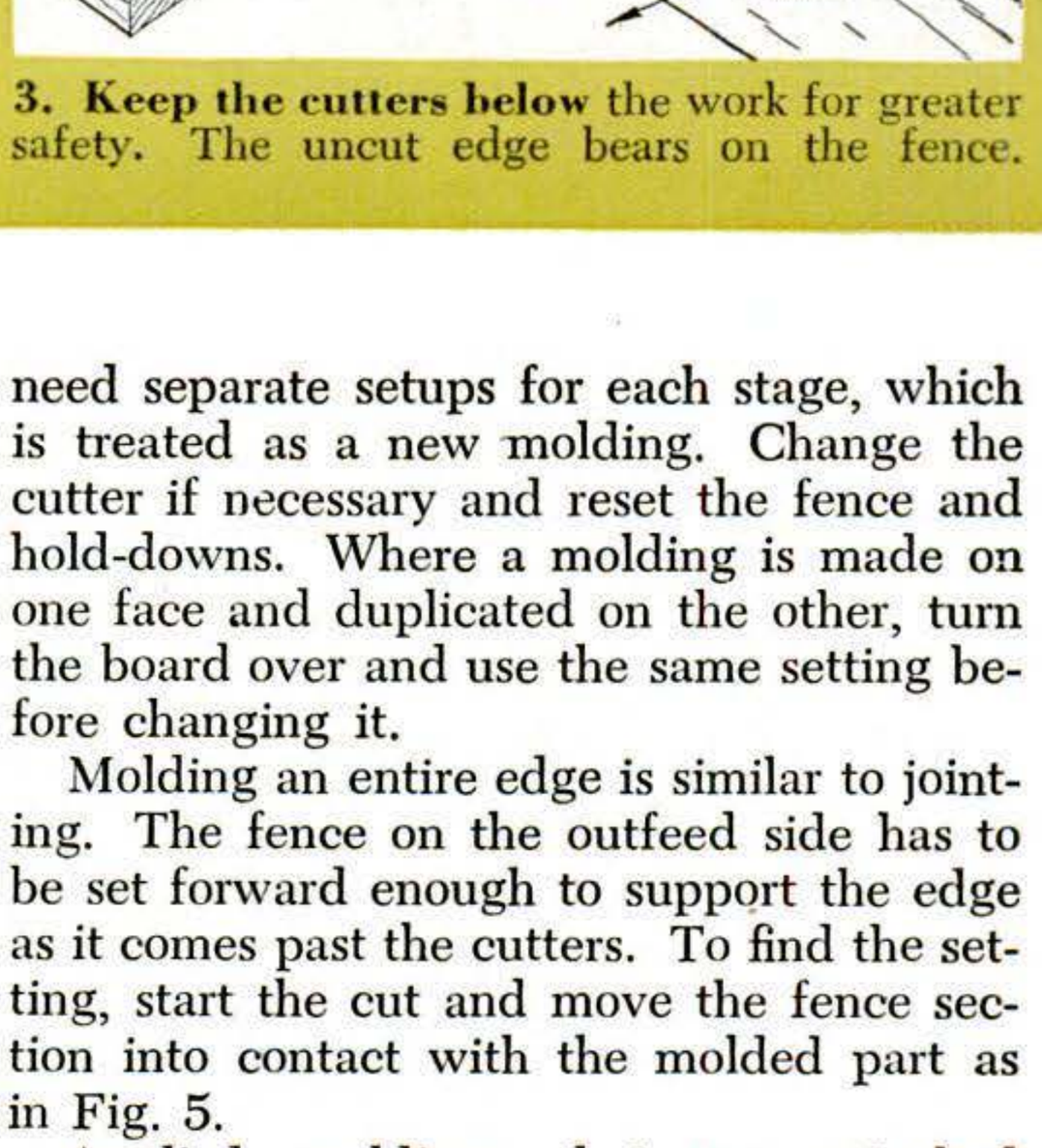
1. **Wing cutters** come in many shapes and sizes. Blades are inserted in molding heads, bottom.



REEDING AND FLUTING COMBINATIONS

2. **Beads,** flutes, quarter and half rounds can be cut singly or in combinations like these.



3. **Keep the cutters below** the work for greater safety. The uncut edge bears on the fence.

small portion of the edge left unshaped. This straight part guides against the fence, which is set with both sections in alignment. Mount the selected cutter on the spindle, using collars beneath it if necessary to raise it to the correct height.

Whenever possible, orient the work and the cutters so that the face bears on the table as in the left-hand sketch of Fig. 4. This puts most of the cutter out of the way of your fingers and assures a uniform depth even if there is some variation in the thickness of the wood. If the shaper isn't reversible, you may sometimes have to cut on the upper face of the piece. Use a small collar that won't project beyond the cutting parts of the blade and, especially on narrow work, use hold-downs and other safety devices.

Make test cuts on scrap before running the mold. Hold the work firmly against fence and table and feed it smoothly past the cutter. Some combinations of cuts require the face of the piece to slide against the fence while the edge rests on the table, as in the right-hand drawing, Fig. 4.

Moldings made by combinations of cuts need separate setups for each stage, which is treated as a new molding. Change the cutter if necessary and reset the fence and hold-downs. Where a molding is made on one face and duplicated on the other, turn the board over and use the same setting before changing it.

Molding an entire edge is similar to jointing. The fence on the outfeed side has to be set forward enough to support the edge as it comes past the cutters. To find the setting, start the cut and move the fence section into contact with the molded part as in Fig. 5.

Applied moldings that are attached around the edges of cabinet tops, panels, and similar units can be narrow strips. They are most easily made by shaping the edges of boards and ripping them off afterward. This procedure, however, may be too expensive for valuable woods. To conserve costly stock, and also as a means of salvaging waste rippings, it pays to make a jig of the type shown in Fig. 6. The jig is a wooden bar (inset) hollowed to give cutter clearance. A couple of scroll-sawed wooden springs are fastened to the underside. The

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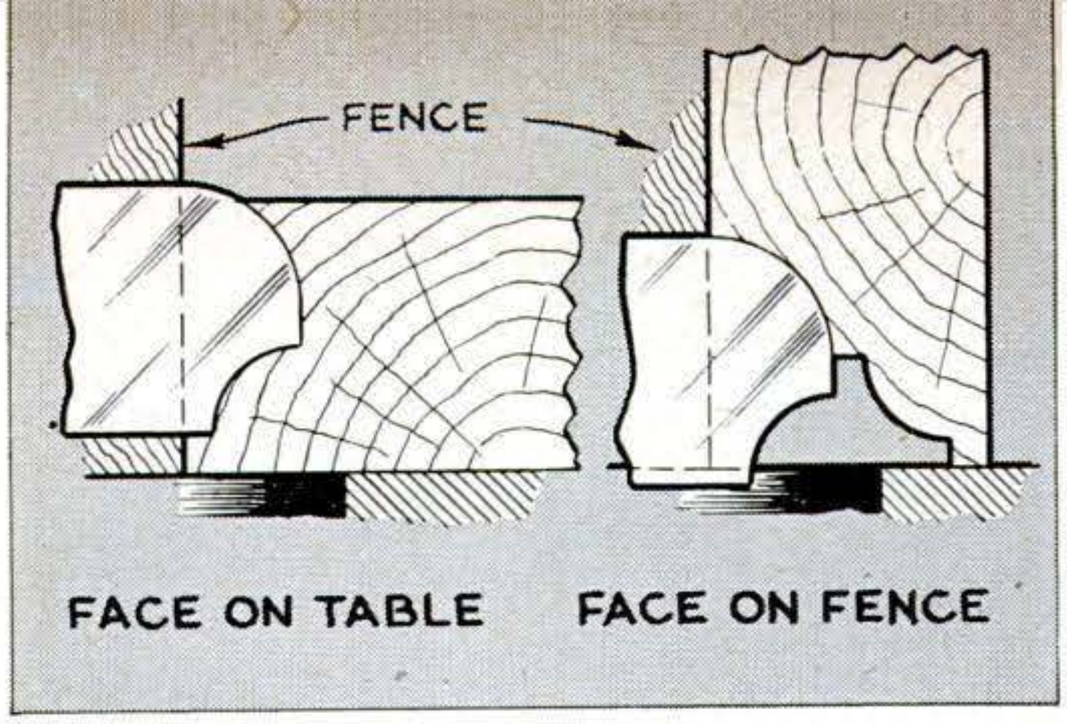
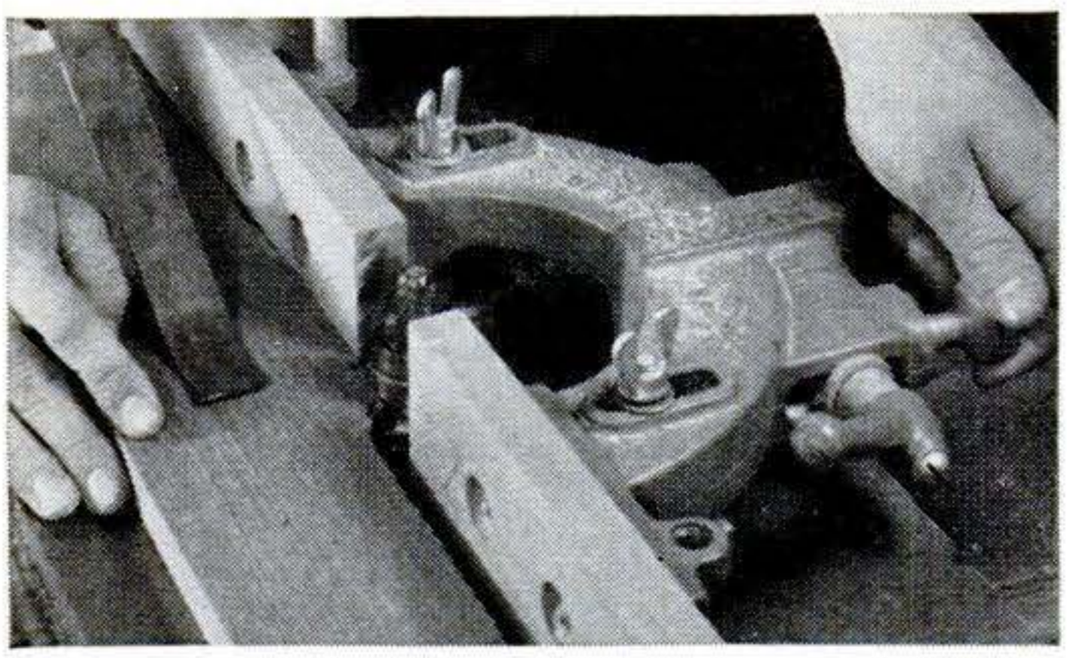
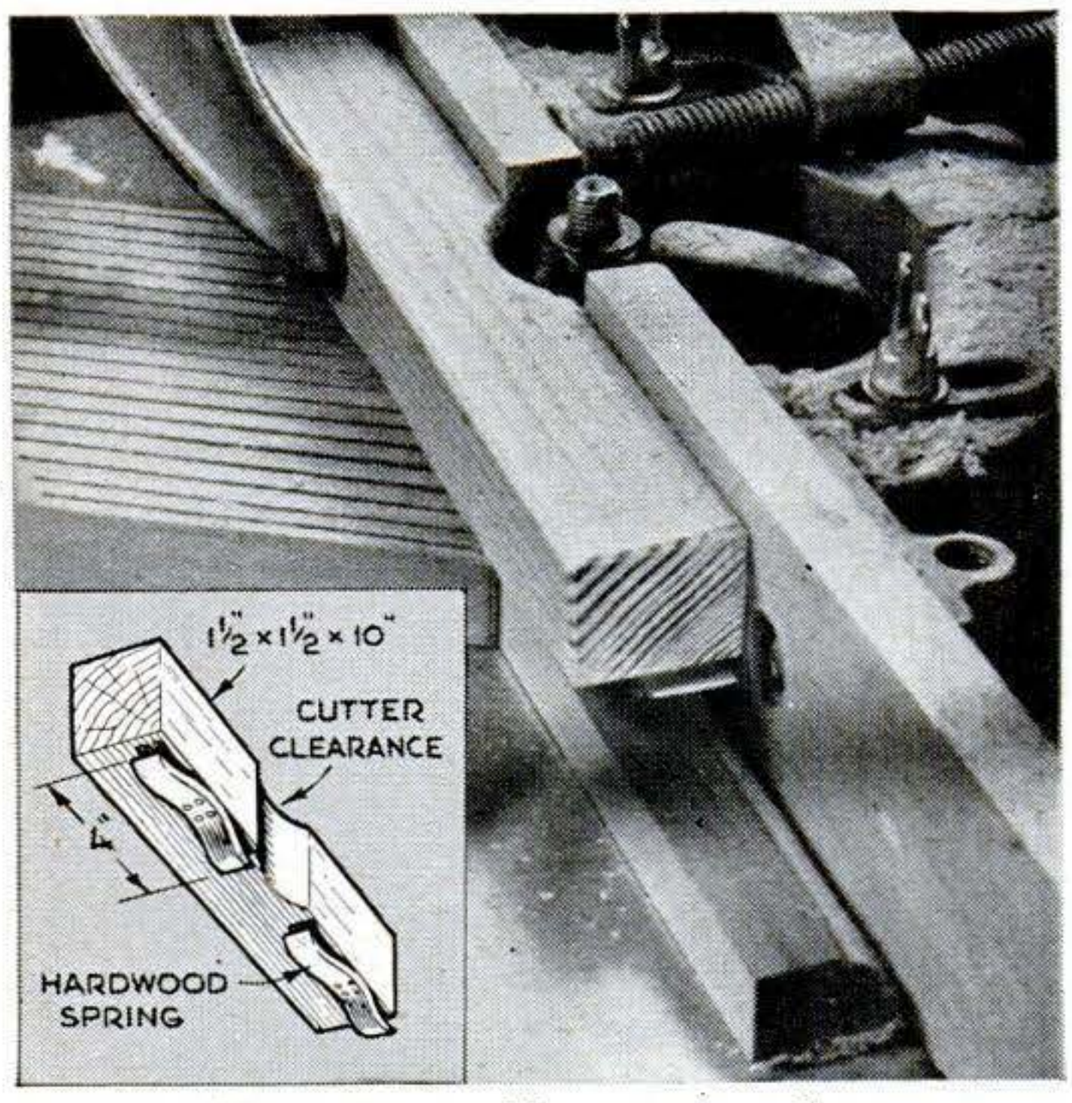


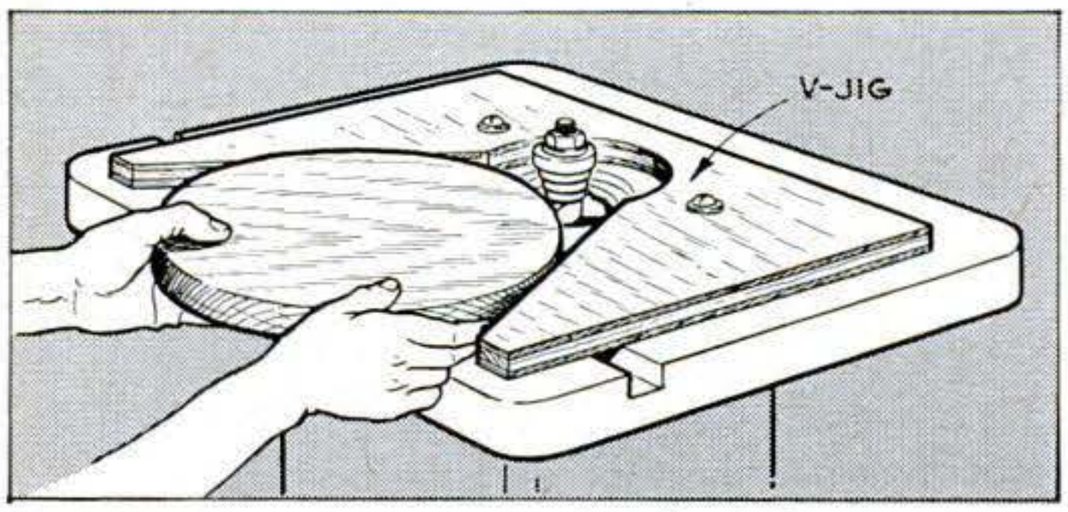
4. Slide the face on the table whenever possible, against fence only for special cuts, above.



5. In shaping an entire edge, set the outfeed fence forward to support the molded portion.



6. A molding jig enables you to salvage waste rippings or shape thin strips of costly wood.



7. Circular stock is easily shaped with a V- or pivot jig. Reset the jig for each setback.

bar is clamped to the fence where it will bear firmly on the top of the strip. If the fence is offset for a full molding, place a shim between the jig and the infeed section when clamping the bar. A kerfed wooden spring clamped to the table holds the strip against the fence. Push the work in at one end and pull it out at the other. You can use the same jig to groove or rabbet strips before molding them.

Circles are as easy to shape as straight edges if a pivot or a V-jig (Fig. 7) is used. It's necessary to reset the jig when making stepped-back moldings or those requiring two or three passes. When molding the full edge all around a disk with a V-jig, mark the starting point so you can stop feeding the work exactly at the end of one revolution.

A tilt table for mitering and molding beveled edges is illustrated in Fig. 8 and a simplified version is detailed in Fig. 9. With both of these, the fence sections can be clamped at the proper angle for any molding. Attach the table with the regular frame studs or with a C-clamp.

Figure 10 shows a molding being made on a drill press. The process is identical with shaper practice except that the spindle is above the work. An auxiliary table is a convenience. For a fence, clamp a strip of wood in place. The usual cutters for drill-press shaping are small three-winged ones with 5/16" holes, similar to the larger types. Built-up heads into which blades can be inserted are also available. Use special adapters rather than the usual drill chuck for the cutters.

You can use a molding head on a shaper, too. One suitable type is pictured at the bottom of Fig. 1. Blades to be inserted can be purchased in a variety of patterns, usually at lower cost than an equal assortment of wing cutters. With a molding head, too, the larger diameter of sweep allows deeper setbacks on shaped edges.

Molding heads for circular saws resemble the smaller shaper variety and use the same blades. If your saw fence is not arched for use with a molder, screw or clamp to the saw fence a flat board, arched to suit (Fig. 11). Place the work face down on the table or slide it on edge, according to the molding desired. To insure uniform contact of the cutter and curved work, make a pencil mark on the fence or table at the center of the arch. Expose only as much of the cutter as is needed for making the molding.

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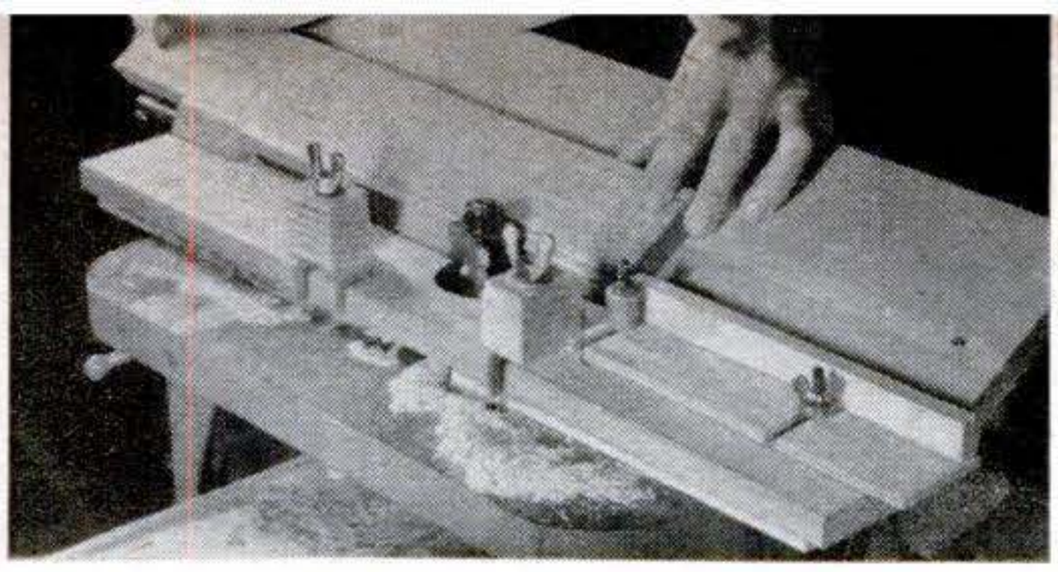
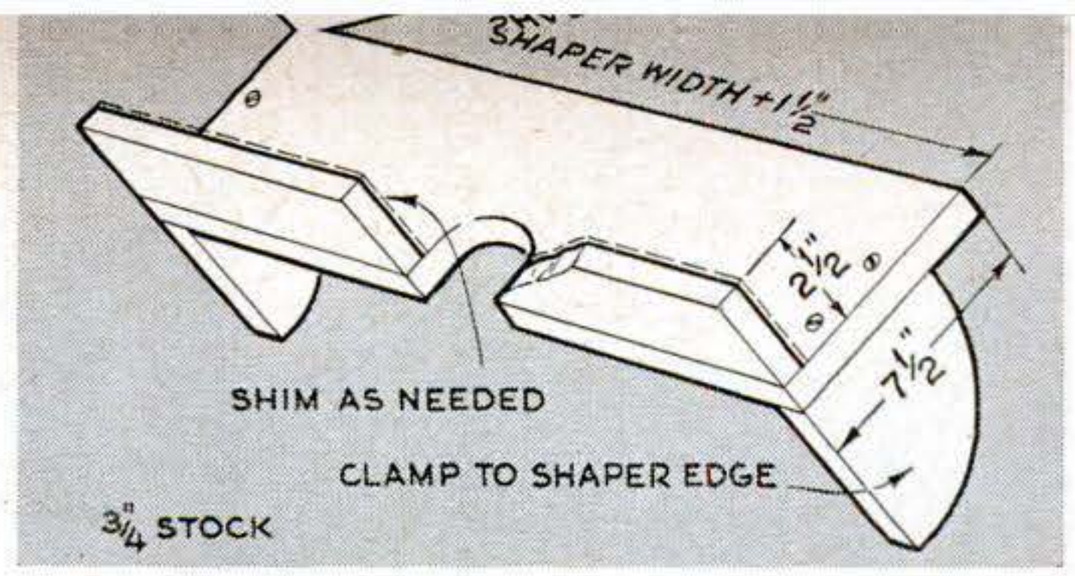
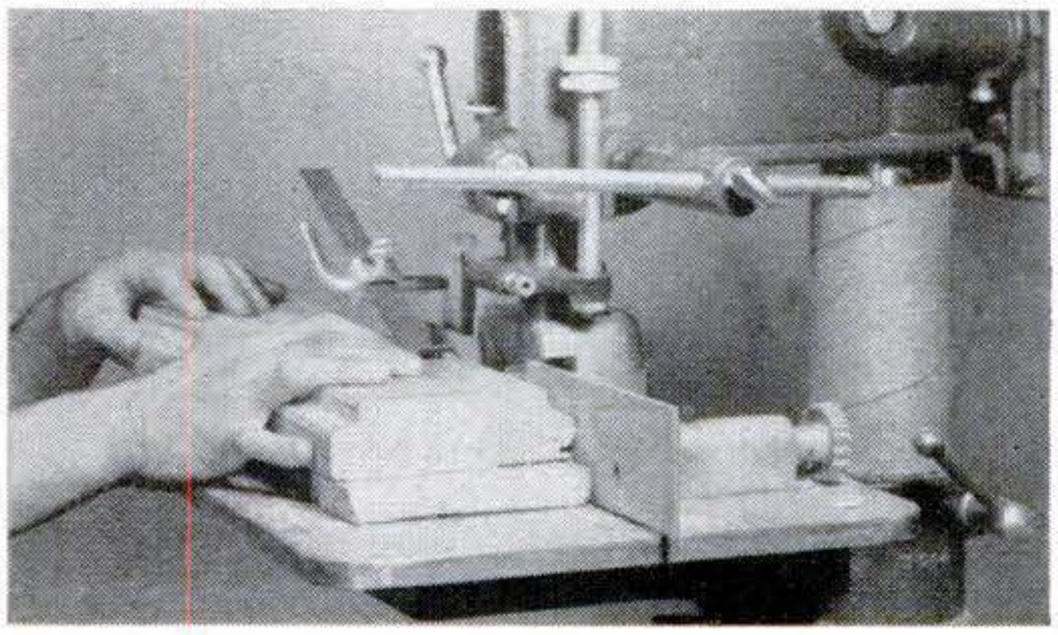


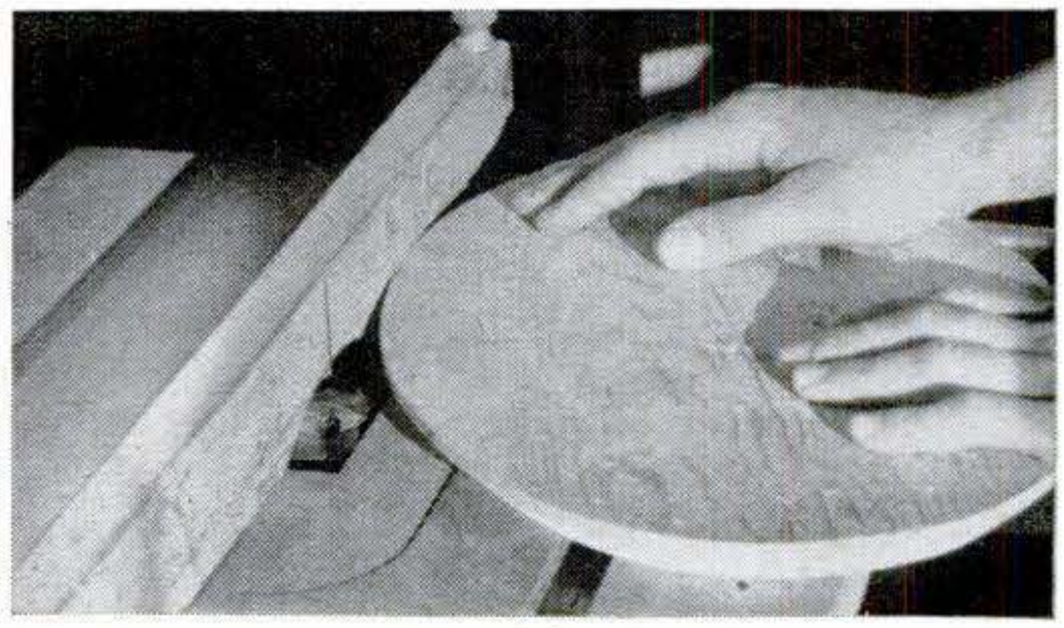
8. A tilt table made to fit your shaper is an aid in mitering or in molding a beveled edge.



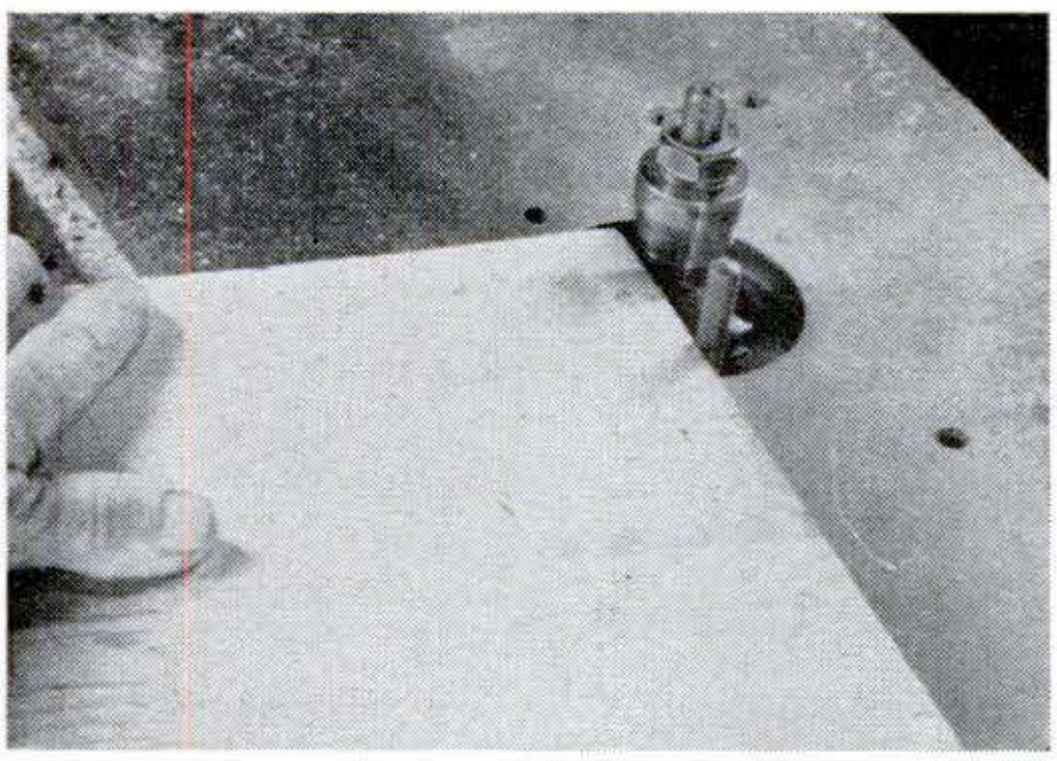
9. A simplified version of the table at left can be made according to these specifications.



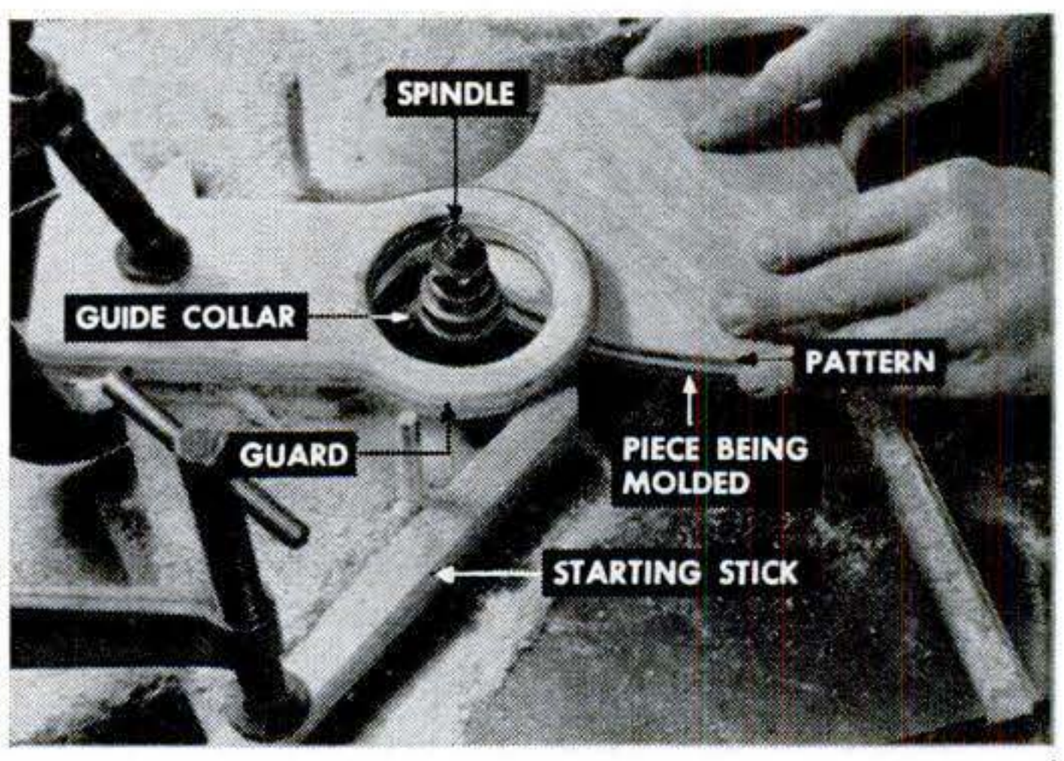
10. Molding on a drill press is the same as on a shaper except that the spindle is above.



11. Special heads enable you to use a circular saw for shaping any straight or convex edge.



12. For freehand work the shaper has no peer. Collars of the right diameter guide the edge.



13. To mold an entire edge, tack a pattern to the workpiece so it will bear on the collar.

It is in freehand molding of irregular edges that the special capabilities of the spindle shaper are exhibited. Cutting a uniform molding requires that the edge of the work be kept at a constant distance from the center of the spindle. With the shaper this is accomplished by mounting a collar of proper diameter above or below the cutter. Revolving with the cutter, the collar bears against the work, keeping the work-to-spindle distance uniform. The transfer is so accurate that any bump or groove in the sawed edge of the wood will be repeated in the molding, so you'll want to be sure that it has a true edge to start with.

Starting is the critical point in freehand shaping, but grabbing of the cutter can be prevented by feeding the work gradually into the blades. Most shapers are provided with tapered pins to be inserted in holes on the feed side of the spindle. Press the edge of the piece against the pin as in Fig. 12, and pivot it slowly toward the blades. Where possible, start the cut with the grain. Once the molding has reached full depth, swing the piece away from the pin.

To use the collar effectively, it must have some wood to bear against. Where the entire edge is to be molded, tack on an accurate pattern as shown in Fig. 13. Because the collar guides the pattern, the piece to be shaped can be an oversized, roughly cut scrap. In the same picture note the plywood guard shimmed up at such height that it serves also as a hold-down. The guard interferes with the starting pin, so a pointed stick is clamped to the table to substitute for the pin. END

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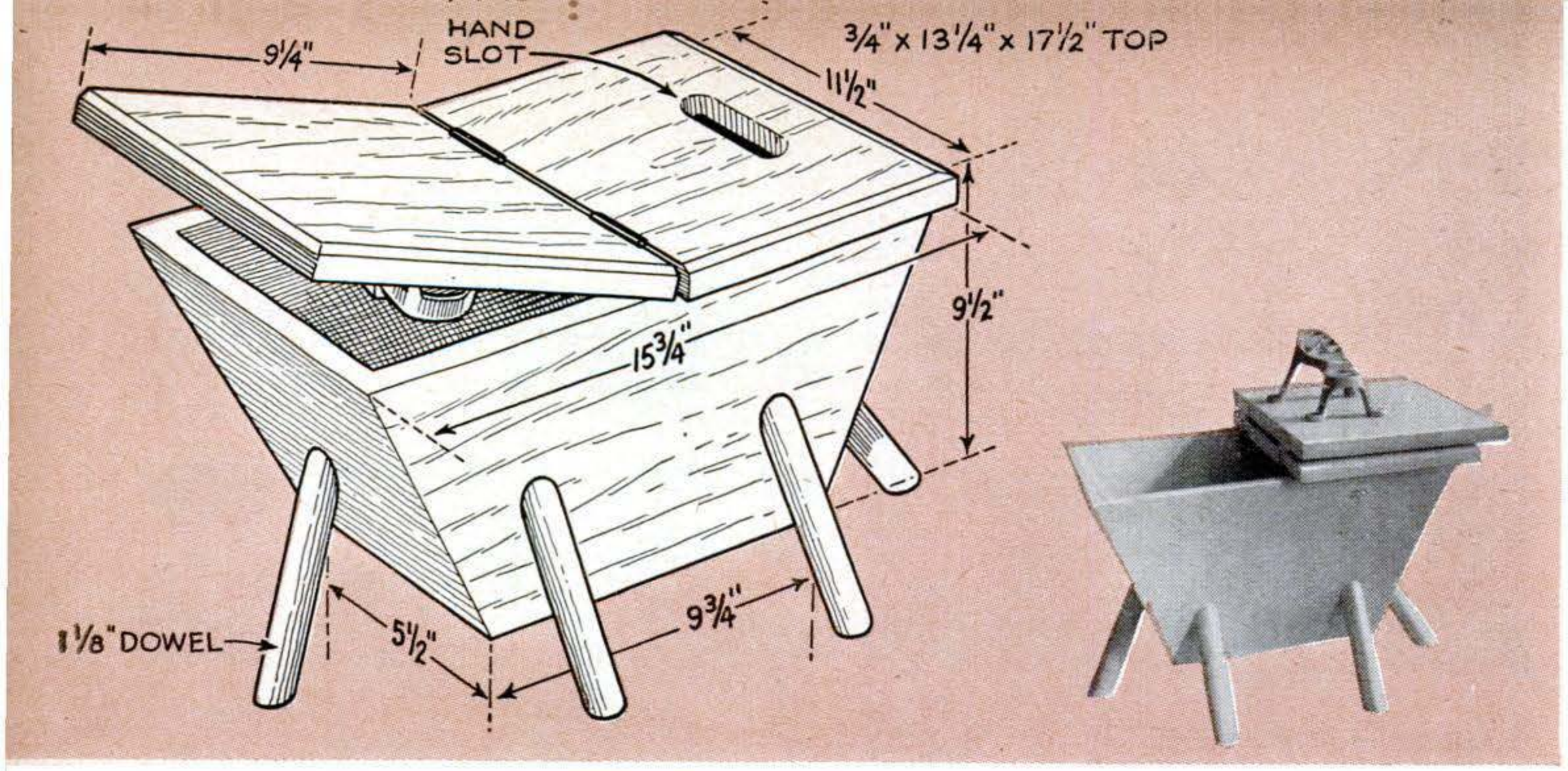
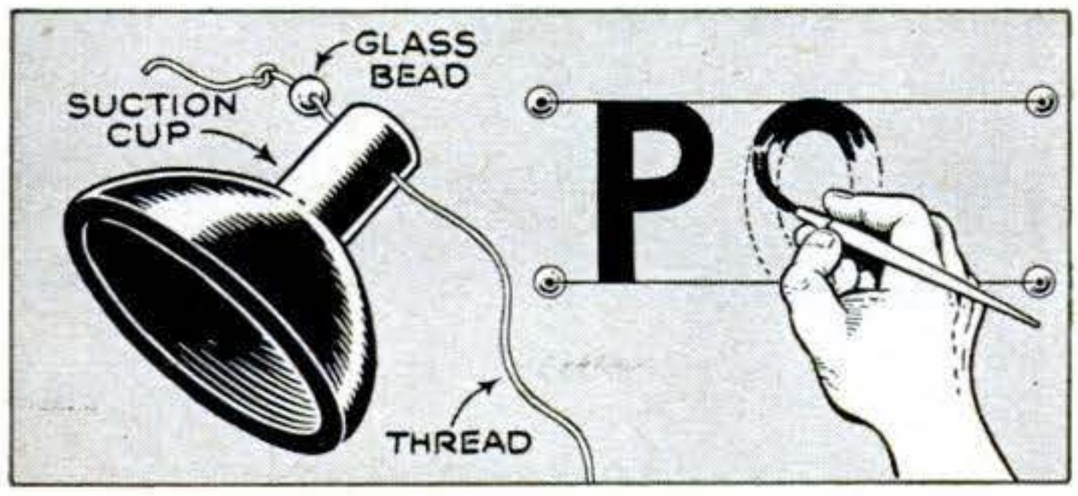


Footstool Combines Shine Box

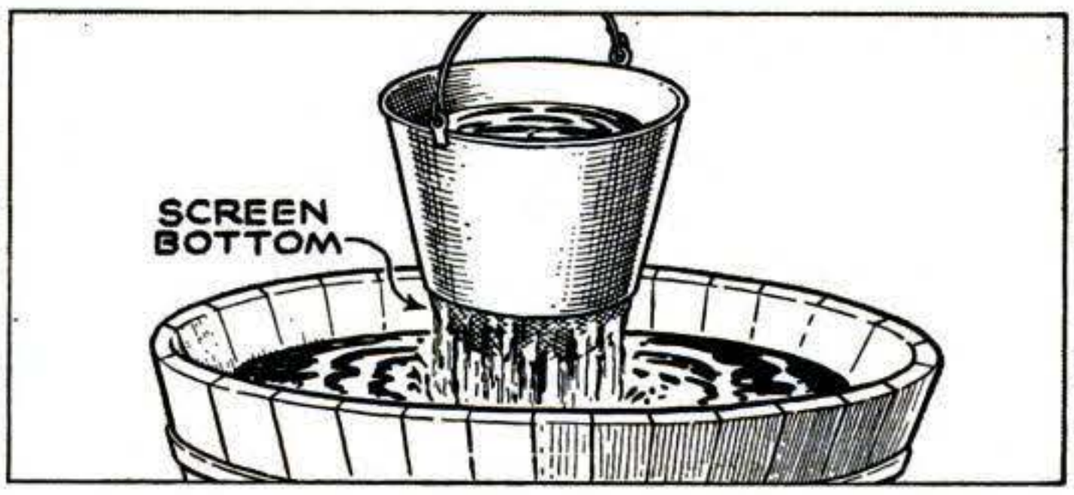
PATTERNED after the handiwork of the Pennsylvania Dutch, this shoeshine box doubles as a footstool. Although the one pictured above is undecorated, its simple lines adapt it to stenciled designs taken from Pennsylvania Dutch furniture. (PS, May '46, p. 116.)

The bottom and top are cut from ¾" plywood and the sides from ½" stock. There are a couple of ways to assemble the box. I mitered the edges of the four sides, laid them edge to edge, and applied cellulose tape as hinges after smearing glue on the mitered edges. Folded into box shape, the sides were held by the tape until the glue had set. Afterward, I removed the tape and strengthened the sides with brads. An alternate method would be to miter and spline the sides. The legs are held by screws.—*S. Manville, Manhattan, N. Y.*



Thread Forms Guide Lines

WHEN painting signs on glass, I hit on this method of laying out true guide lines. Using four small suction cups, I strung stout thread between each pair. The thread, pushed through holes in the handles of the cups, was tied to a bead. These lines stay put and are always straight and parallel, provided the cups are equally spaced on each side.—*Charles Mills, Millington, Mich.*

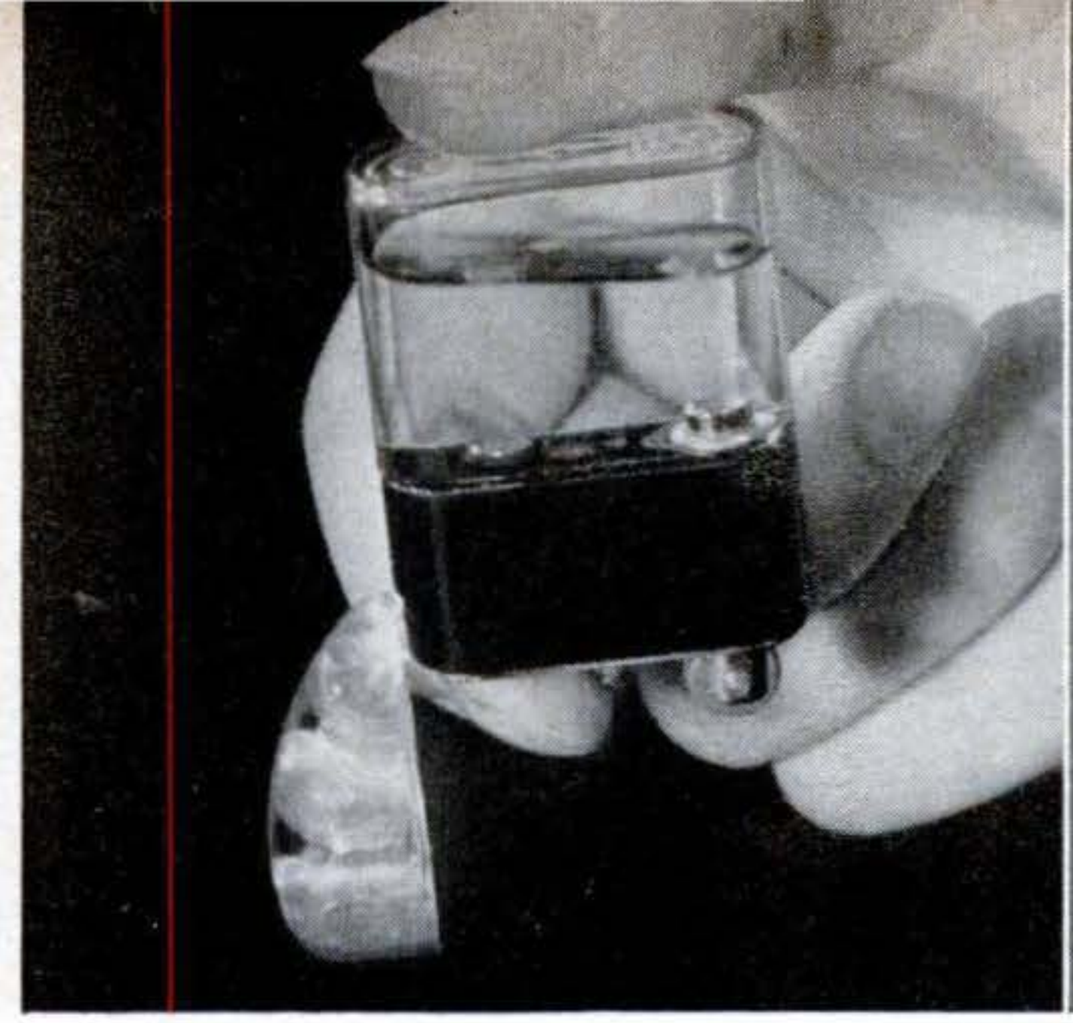


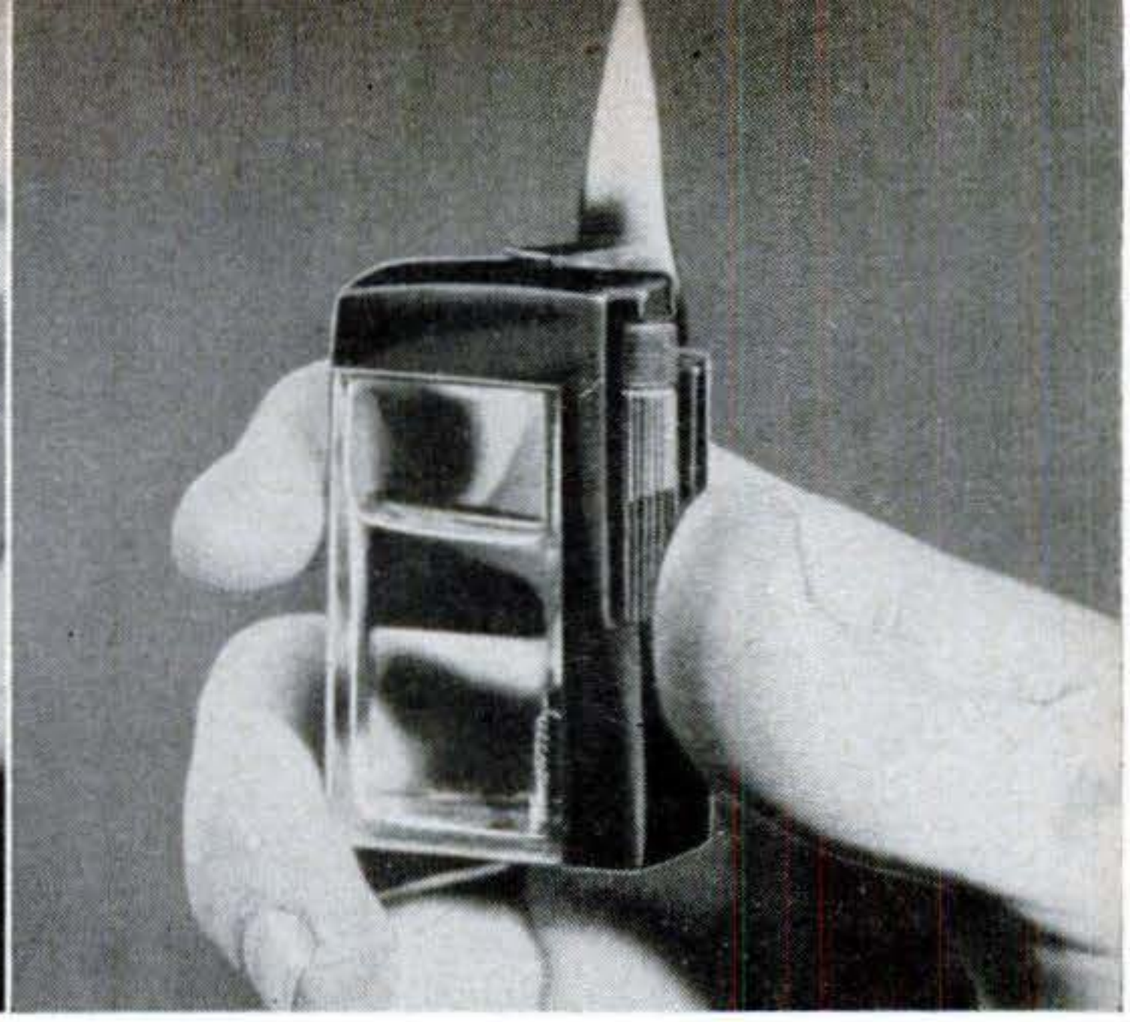
Bucket and Tub Wash Sand

I HAD a quantity of sand to screen but found the going tough because the sand was damp. To speed up the operation, I cut the bottom out of an old bucket and fitted a sieve in its place. Then I shoveled sand in the bucket and dunked it up and down in a tub of water. The sand went into the tub and I shoveled it out.—*Arthur Kenville, Felton, Calif.*

Lamp Has Five-Way Switch

THE Pro-Tex-U-Lite®, made by Weiser-Hill Mfg. Co., Canton, Ohio, gives motorists five lighting combinations: red flasher and trouble light, steady red light and trouble light, trouble light alone, red flasher alone, and steady red light alone.





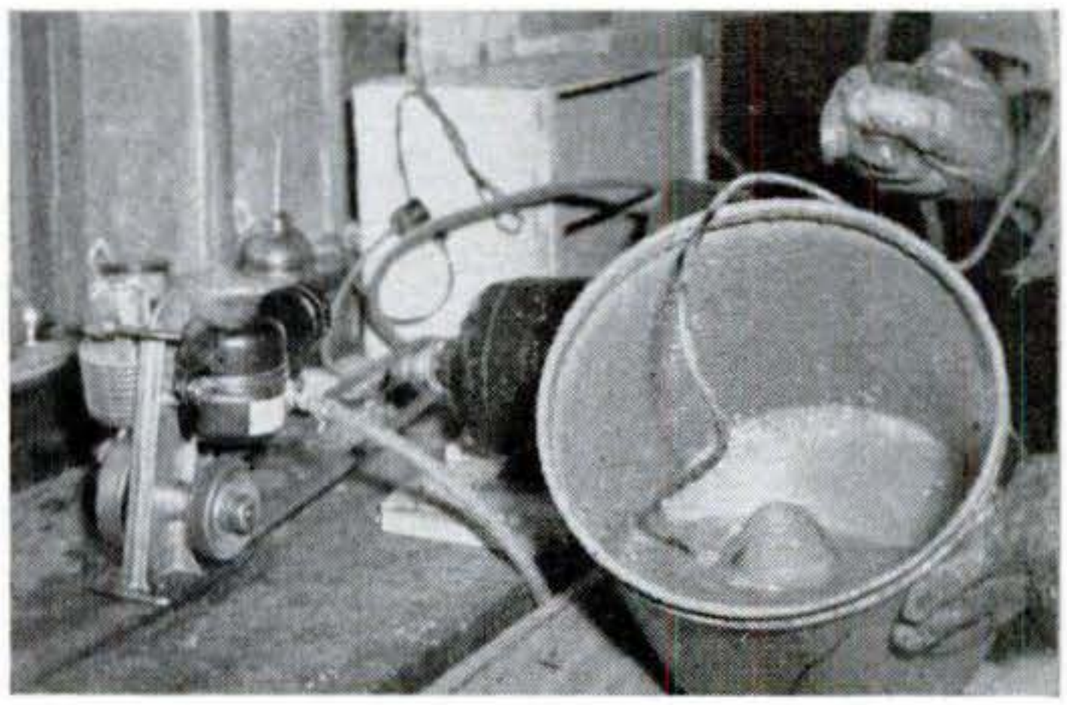
Lighters Show Fuel Supply

Two cigarette lighters with clear plastic fuel reservoirs are now on the market. Each sells for about $5.

At left is the Ritepoint Liter ®, made by the Ritepoint Co., St. Louis, Mo. It is available in four different colors. The fuel supply is transferred to the wick as needed by a finger-touch valve. The one at the right is manufactured by the Video Lighter Corp., Chicago. It's said to give 4,000 lights with one fueling. The gift box in which it comes serves as a cigarette container.

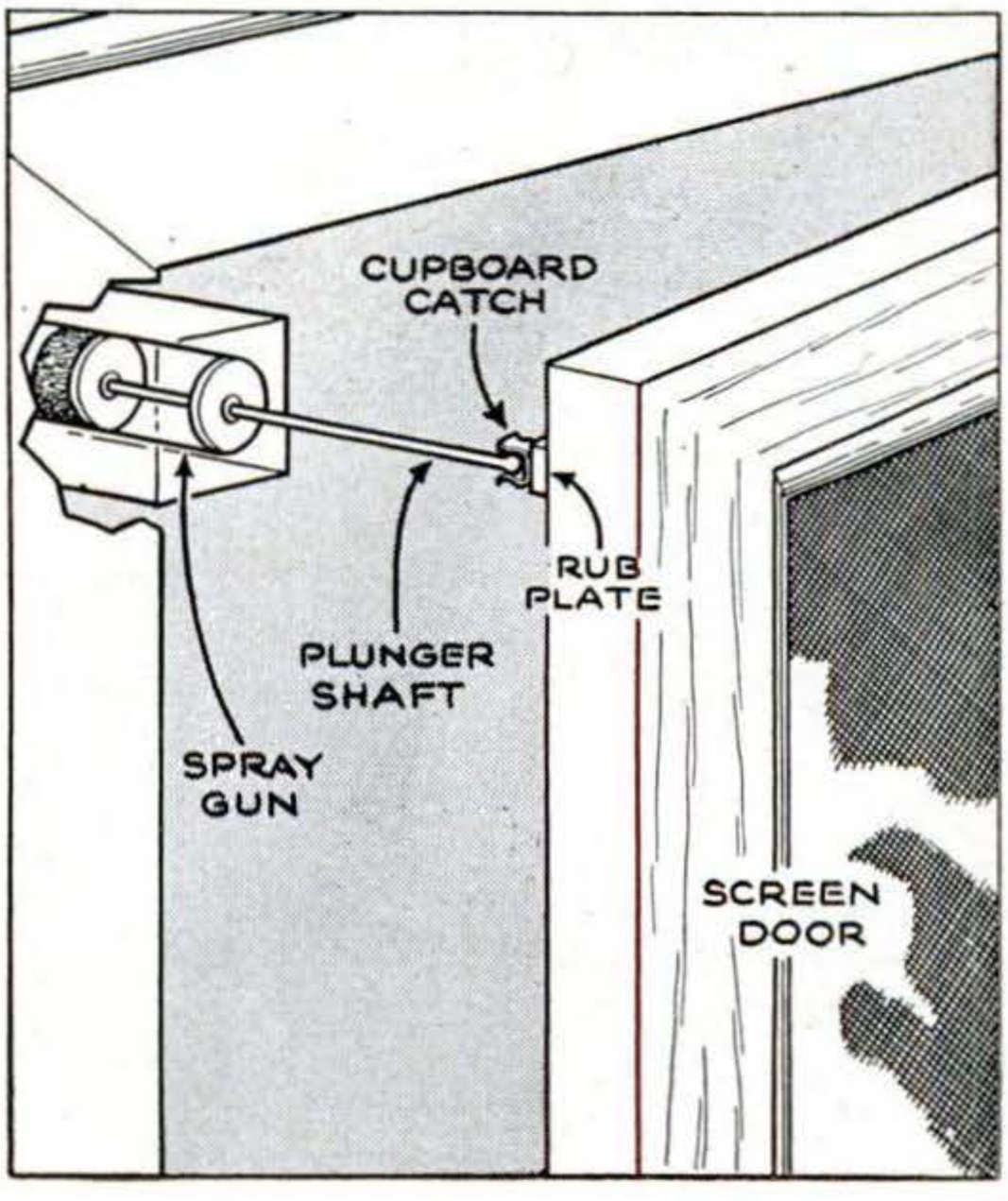
Compressed Air Stirs Paint

OLD paint that has become thick and lumpy can be renewed with the aid of a small air compressor and a copper tube that pipes the air to the bottom of the paint can. Add some thinner to dissolve the lumps, and force air through for five to ten minutes. There will be little mess to clean up if the pressure is controlled so that the paint doesn't bubble too violently.—*Leonard O. Timm, Bennington, Neb.*



Spray Gun Checks Screen Door

SCRAP parts and an old insect spray gun went into this compressed-air doorcheck for a screen door. When the door strikes the protruding arm, the air gradually leaks out around the plunger, allowing the door to ease into place. Remove the solder holding the nozzle and cap on the cylinder with a small alcohol torch. Hacksaw the cylinder so its length is about 1¼" less than the distance between the inner and screen doors. This allows for mounting in a ¼" plywood box inside the door frame. Solder the cap back in place and close the vent hole with solder. Push the plunger as far forward as it'll go and saw it off ½" from the end of the cylinder. To pull the plunger out when the door was opened, I mounted a cupboard catch on the screen door. It grabs the plunger, draws it out, and lets go.—*Gene L. Henderson, San Ysidro, Calif.*



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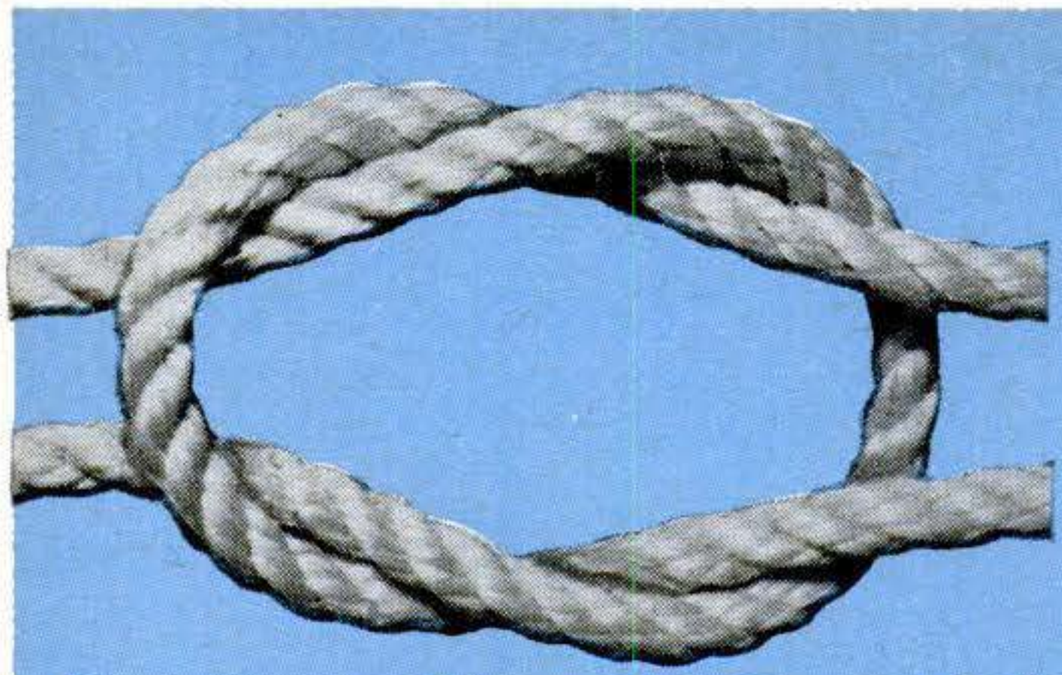
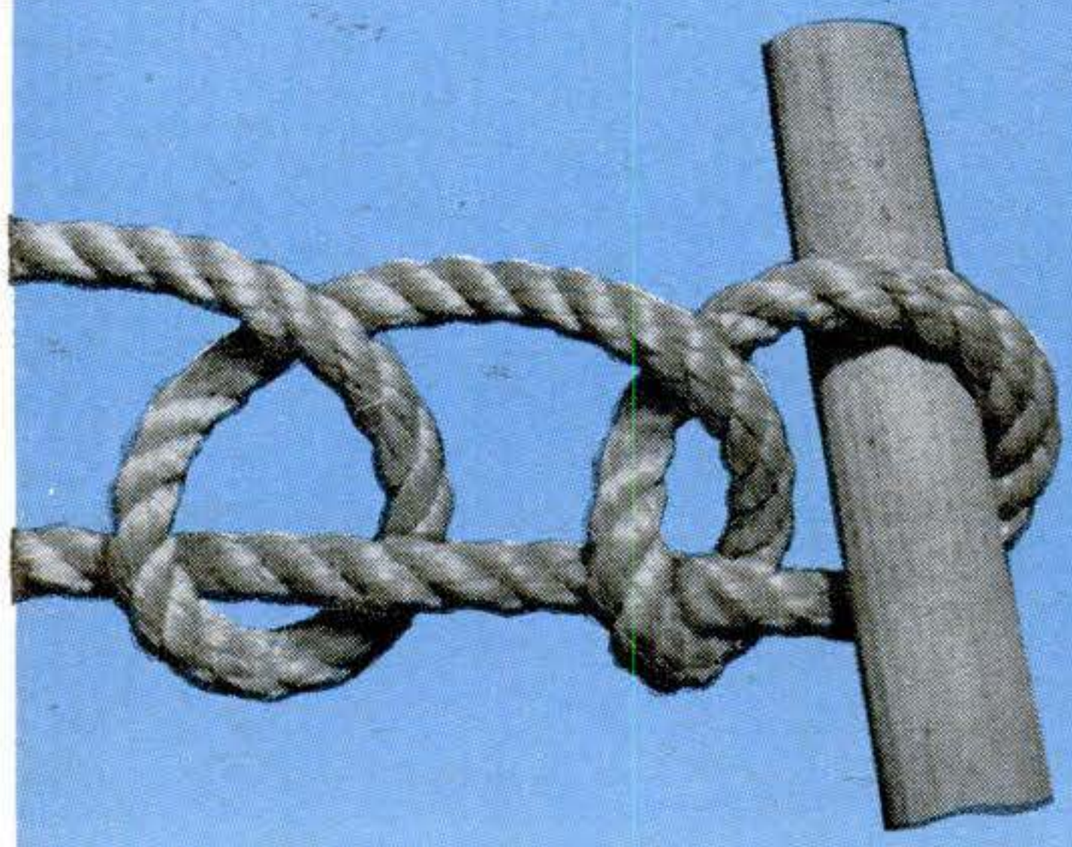
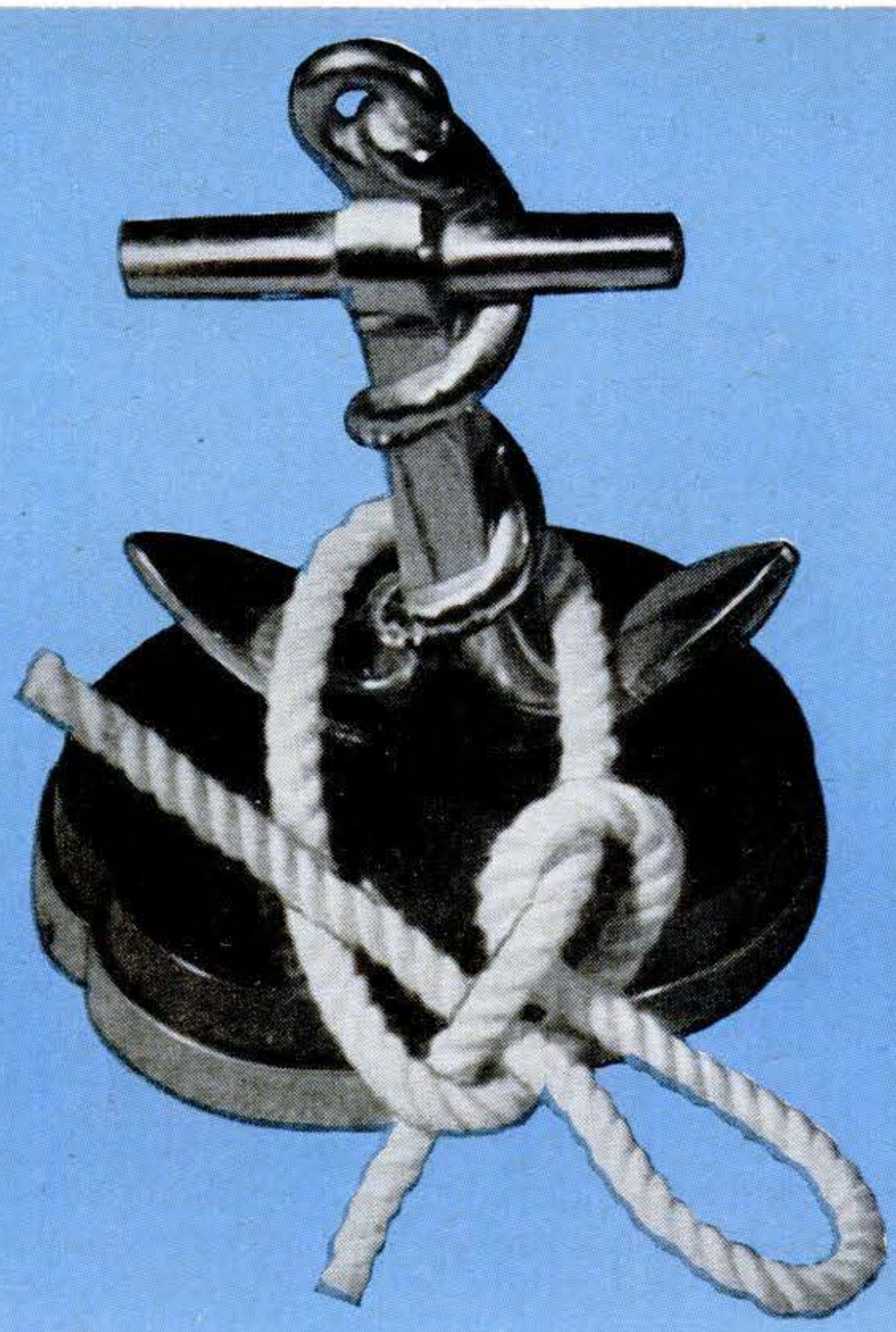


Square or reef knot. It's one overhand knot with another overhand tied on top the first but in the opposite way.



Two half hitches. Use this one for mooring a boat or for tying up a bulky bundle such as a mattress.



Hackamore tie. Holds well, but a yank on the free end automatically unties this one. You'll find lots of uses for it.

Knot It Right

By Roland Cueva

SIX simple knots, pictured here, are like half a dozen extra hands. You'll find them useful at home, in the shop, and on camping trips. They're easy to tie and untie. Used in the right spots, they'll speed up such commonplace jobs as tying a package, attaching a towline, or joining two ropes.

One of the oldest knots is the square or reef. Use it in joining two ropes of the same diameter, in tying bundles, bandages, and the reef points in sails. This knot was known in ancient Rome and Greece. Reproductions of it are found as ornamentation on carvings.

The square knot is two simple overhand knots, the second one tied in the opposite manner from the first. When tied on many packages — and always on shoelaces — the ends are doubled in the second knot to form a bow. The surgeon's knot is similar to the square except that a double overhand knot —two turns—is tied first and then the second overhand knot is made in the opposite direction.

Just below the square knot, in the above photos, are two half hitches. This useful knot serves many purposes, since it can be quickly tied and untied. Use it to moor a boat or to tie up a bulky object such as a mattress. You can also secure a towline with it, but the midshipman's hitch makes a better knot for this purpose.

Still easier to untie, but equally secure, is the hackamore tie—shown here looped over

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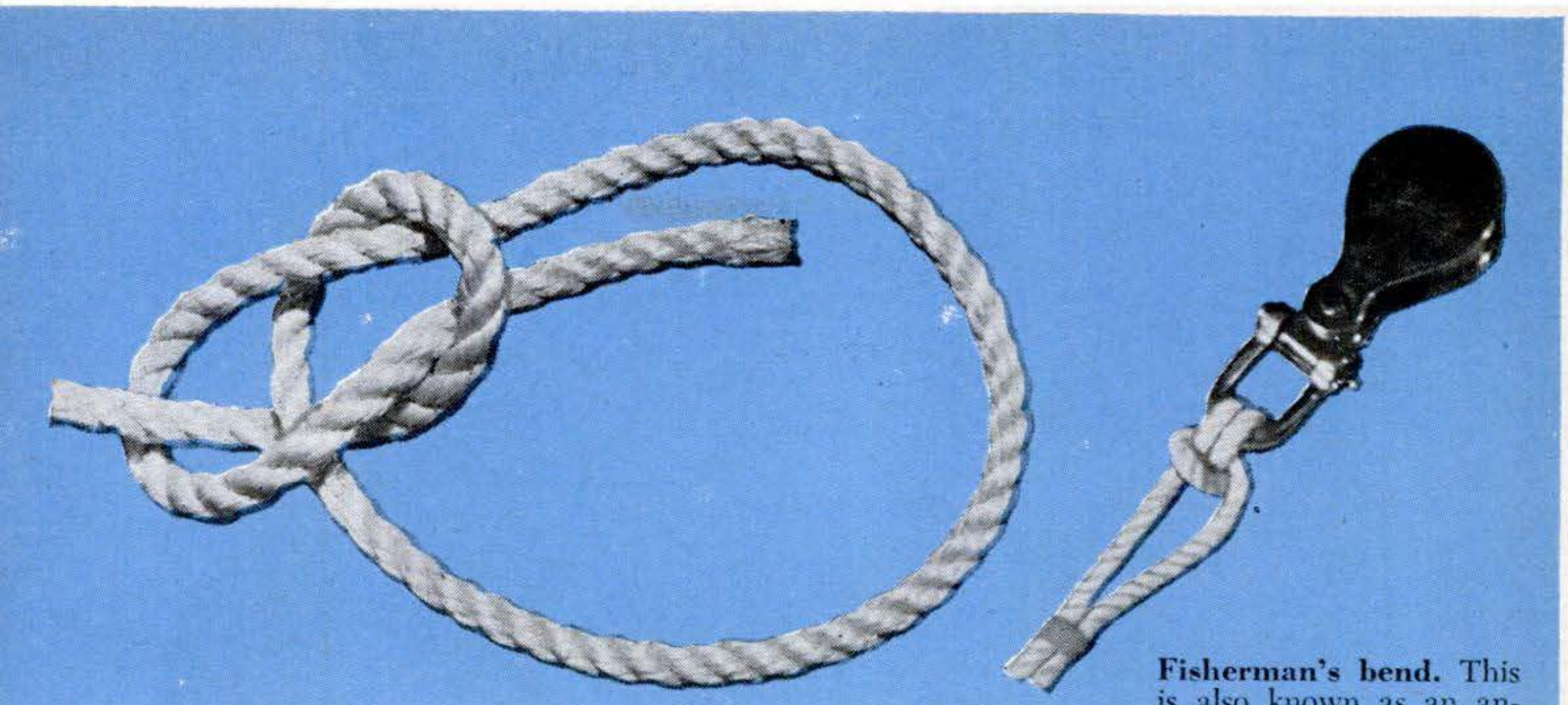
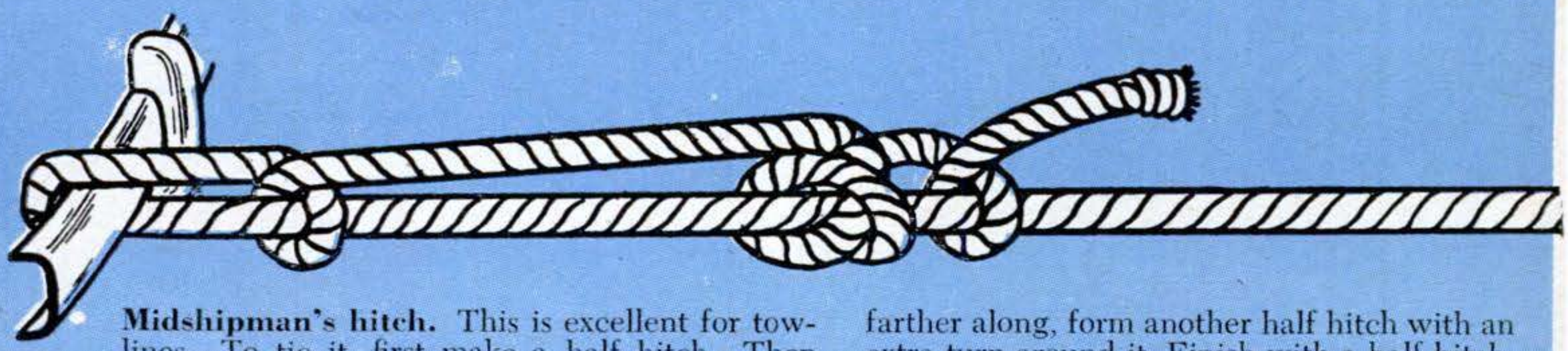


Bowline. Here's a handy way to form a loop in the end of a rope. The bowline won't slip or jam even when heavy tension is applied, and finger pressure loosens it.

Fisherman's bend. This is also known as an anchor bend. After tying it, you can leave the end free or seize it as shown.



Midshipman's hitch. This is excellent for towlines. To tie it, first make a half hitch. Then farther along, form another half hitch with an extra turn around it. Finish with a half hitch.

a miniature anchor. Commonly used to tie a horse, this knot won't slip but a pull on the free end automatically undoes it. Among other things, you can use this knot to tie up plants, bushes, and tree limbs, or to put up a temporary clothesline. It also makes a convenient emergency lashing to hold a gate or door open or closed. In this case, the fixed end of the rope is secured by two half hitches to a ring, bolt, or other projection on the jamb or gatepost. The big loop goes over the doorknob or gate.

An emergency handle for a bundle, box, or suitcase can be fashioned speedily with a bowline—the large knot shown at the top of this page. This old sailor's knot is one of the quickest ways to form a loop in the end of a rope. Its construction is simple but it never jams or slips and can be easily untied. Construction gangs, riggers, and dock workers use this knot extensively. It's good for hauling, mooring, or any other job where a sure fastening to a solid object is required.

When you use a block and tackle to hoist a heavy object, tie a bowline around it. This knot also can be used as a foothold in a rope when working on a tree, wall, or the side of a building. If you have to throw a line to a swimmer who's in trouble, tie a large bowline in the throwing end. It won't slip and it gives the swimmer a good, big loop to grab. You can also make an emergency dog leash with the bowline, using the bowline on the hand end of the leash.

To secure a fishhook to a line or a leader to a line, tie the fisherman's bend. This also is known as the anchor bend since it's used on anchors or for mooring to a ringbolt. The end may be left free or seized as shown. There are other versions of this bend.

The midshipman's hitch is your best bet for towlines, or in any situation where you'll want to quickly lengthen or shorten a rope —as on a tent stake. To slacken the tension, slide the knot toward the stake. To tighten it, move the hitch away from the stake.

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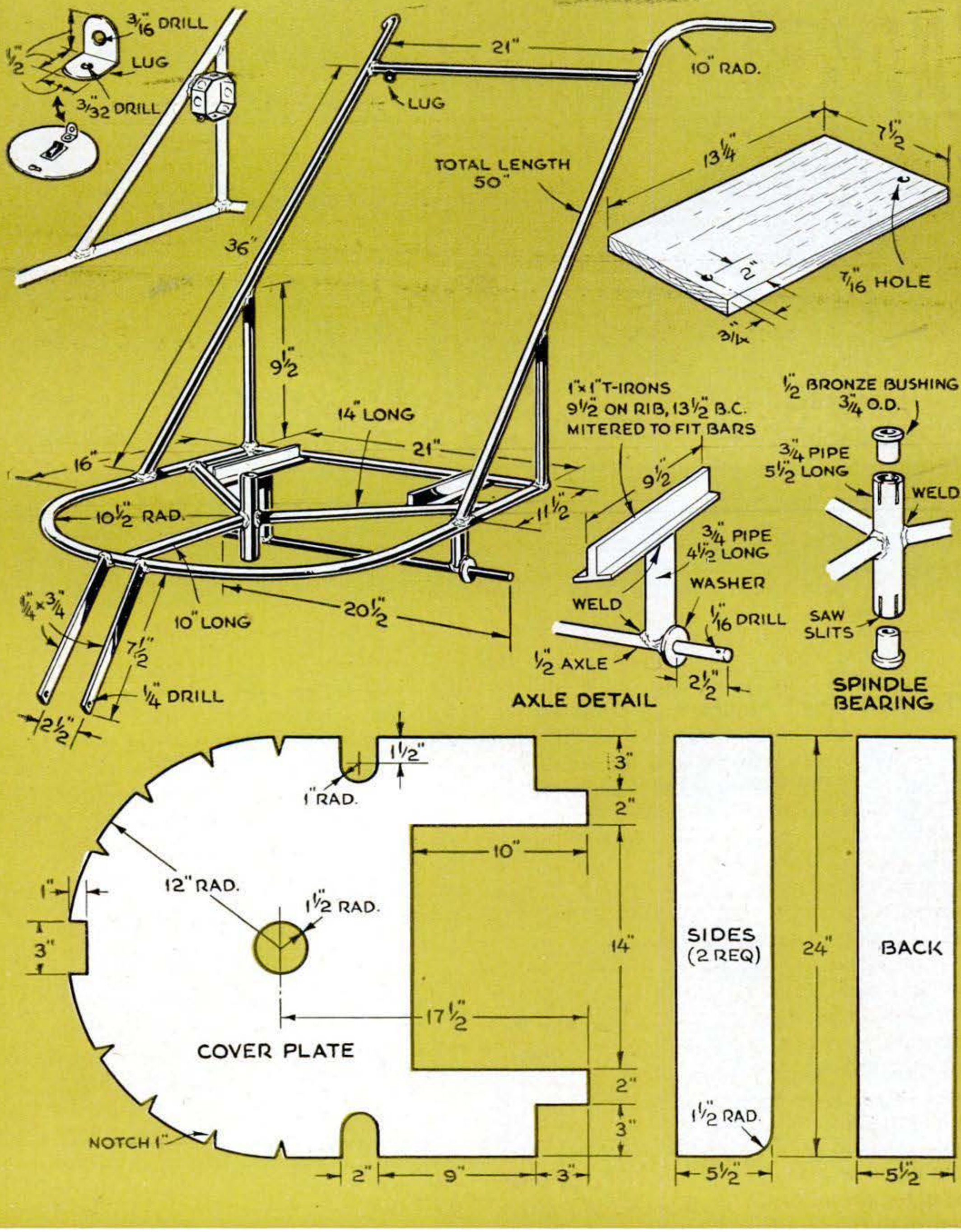
No clatter, no sweat, no cussing when the grass needs cutting. Here's a gadget that puts power to work on your lawn while you loaf along behind.



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Making a Rotary Electric Mower

By Evan Wright

NO MATTER how you cut it, mowing a lawn is still work. The best you can do is to put machinery to work instead of your muscles. That's what this low-cost power mower does. I've built three like the one pictured above. The total cost of this model —exclusive of the motor—was about $15. An old washing machine furnished the motor.

I arc-welded the frame of ⅜″ black pipe, but gas welding or brazing could be used. If you don't have welding facilities, bend up the frame and take the parts to a shop.

Draw full-size patterns of each piece to be bent. Then make a hickey from a 5′ section of ½″ pipe with a tee on one end. The handle bars are bent as shown in the photo on the next page. Start bending the frame with the tee in the center of the arc and bend one half. Return to the center and bend the other half.

Begin with the outer pipe of the bed—a 65″ length. Bend it to a half circle with a 10½″ radius. The two straight sides are 16″ long. Then cut the 21″ rear crosspiece and weld it in place. Make the spindle bearing next. After cutting it to the length shown in the drawing, make two 1½″ saw cuts at right angles in each end. Place shouldered bronze bushings, ½″ i.d. and ¾″ o.d., inside the slit ends. Then compress the ends of the pipe in a pipe vise to a tight fit. Weld the saw slits and, while the pipe is still red hot from the welding, drop it in cold water. This shrinks the iron tightly around the bushings. Drill a ⅛″ hole through the pipe and the top bushing and into the oil grooves for lubrication purposes. The lower bearing is oiled by drip from the top one.

Cut the three radius bars as indicated. Miter the 14″ ones to fit the sides of the frame. With the spindle bearing in place,

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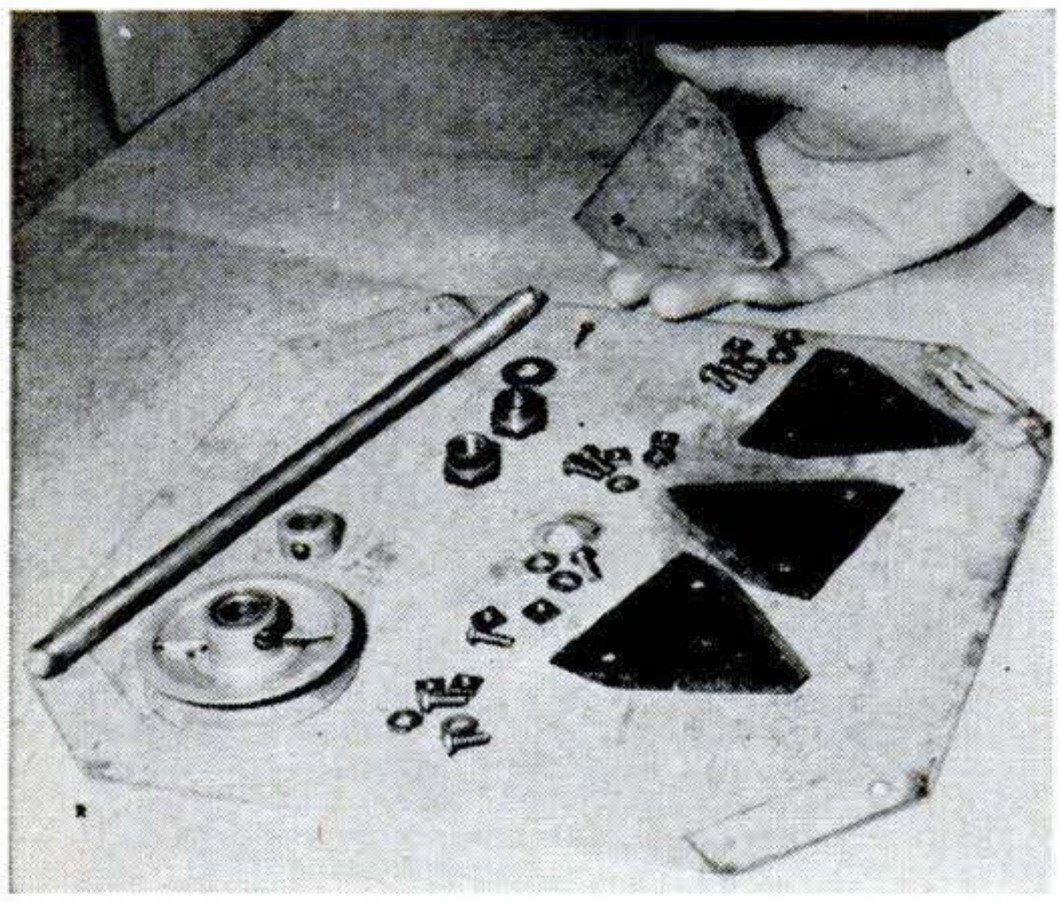
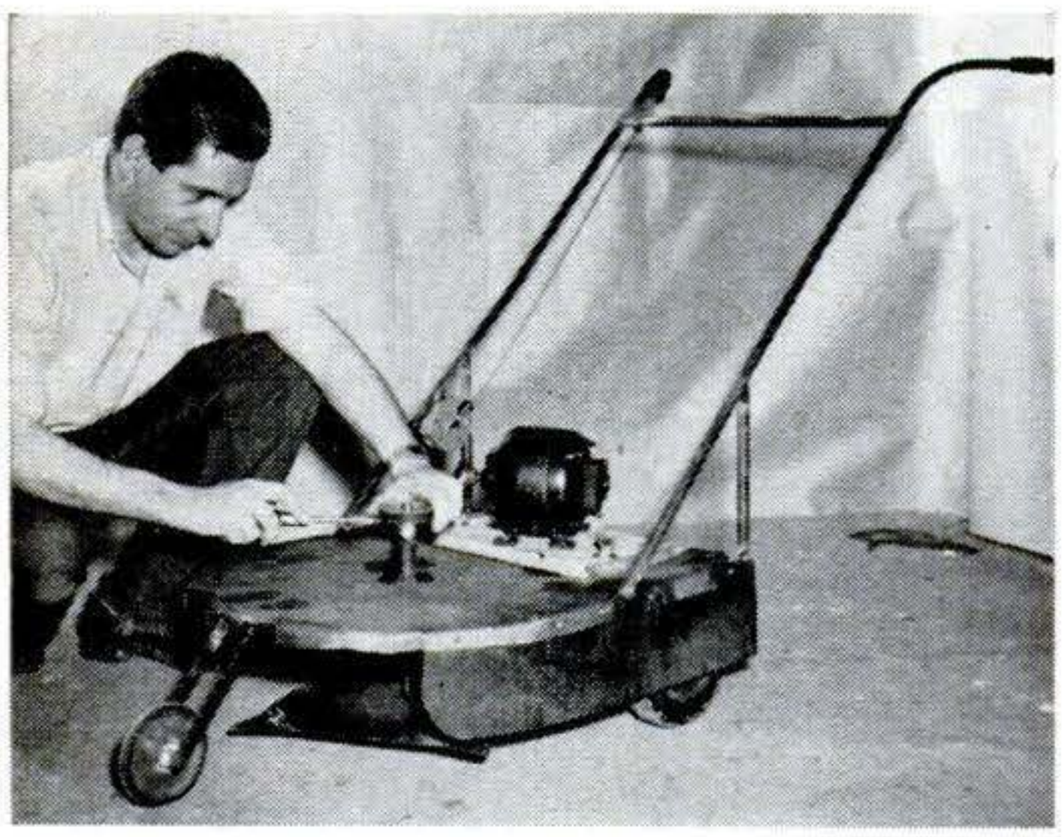
Frame and handle bars are bent of ⅜" black pipe. To do the bending, make a hickey 5' long of ½" pipe with a tee on one end.



Cutter assembly includes 13" square iron plate, spindle, pulley, and collar. Blades are replaceable type used on farm mowers.



Position motor on mounting board at an angle. This centers the motor's weight. Mounting board may be moved back to tighten belt.

block the frame up square and weld it. Next cut the two 1" by 1" T-irons. Miter them for a close fit to the rear radius bars with 13½" between centers and weld them.

Now turn the bed over and weld the two 4½" legs to the T-irons. Weld a ½" cold-rolled steel axle to the legs. To provide a flat bearing surface for the 8" wheels, slip a big washer over each end of the axle and weld them to the legs. Drill 1/16" holes in the axle ends for cotter pins. Make the front fork next. It's dimensioned for a 4" wheel. Put the wheel in place and weld the fork to the frame. Cut the handle bars to 50" and bend them as shown. Miter them to fit the frame and miter the two vertical back braces to fit the handle bars.

The lug shown on the 21" crossbar is bent of ⅛" stock. Drill it 3/16" and weld it 1" from the right handle bar. The other lug for the switch-box plate also is ⅛" iron, but has two holes. Weld the box to the frame so that the toggle switch will be in line with the right handle bar. One of the switch-plate screws that holds the switch will also hold the lug. Bend a loop in an end of a ⅛" drill rod. The rod passes through the two lugs and the loop fits over the toggle switch. Put a knob on the handle-bar end of the rod to complete the switch setup.

A 13" square of 16-gauge sheet iron, with the four corners cut off to leave 3" diagonal edges, takes the blades. These are the type used on farm mowers. Bolt them to the plate with 3/16" stove bolts and lock washers. Drill a ½" hole exactly in the center of the plate for the spindle. Thread an end of the 12" spindle for about 2" to take two ½"-20 flanged nuts that fit on each side of the plate. Drill a hole for a cotter pin in the threaded end. Hold the spindle in the bearing with a ½" collar. Put a 2½" pulley on the spindle and a 2" pulley on the motor.

Cut the motor-mounting board of ¾" plywood. The board fits between the ribs of the T-irons so it may be moved forward or back. Wing nuts and bolts hold it to the T-irons. With the board and motor as far forward as possible, put on the 30" V-belt. Sliding the board back tightens the belt. Connect the motor to the switch and attach as much heavy duty cord as you'll need.

The cover plate, sides, and back are cut from 24-gauge black iron. Bend down the edges of the cover plate to a good fit. Sides, back, and cover are held to the frame by 3/32" stove bolts. Paint the frame and slip rubber grips on the handle bars. **END**

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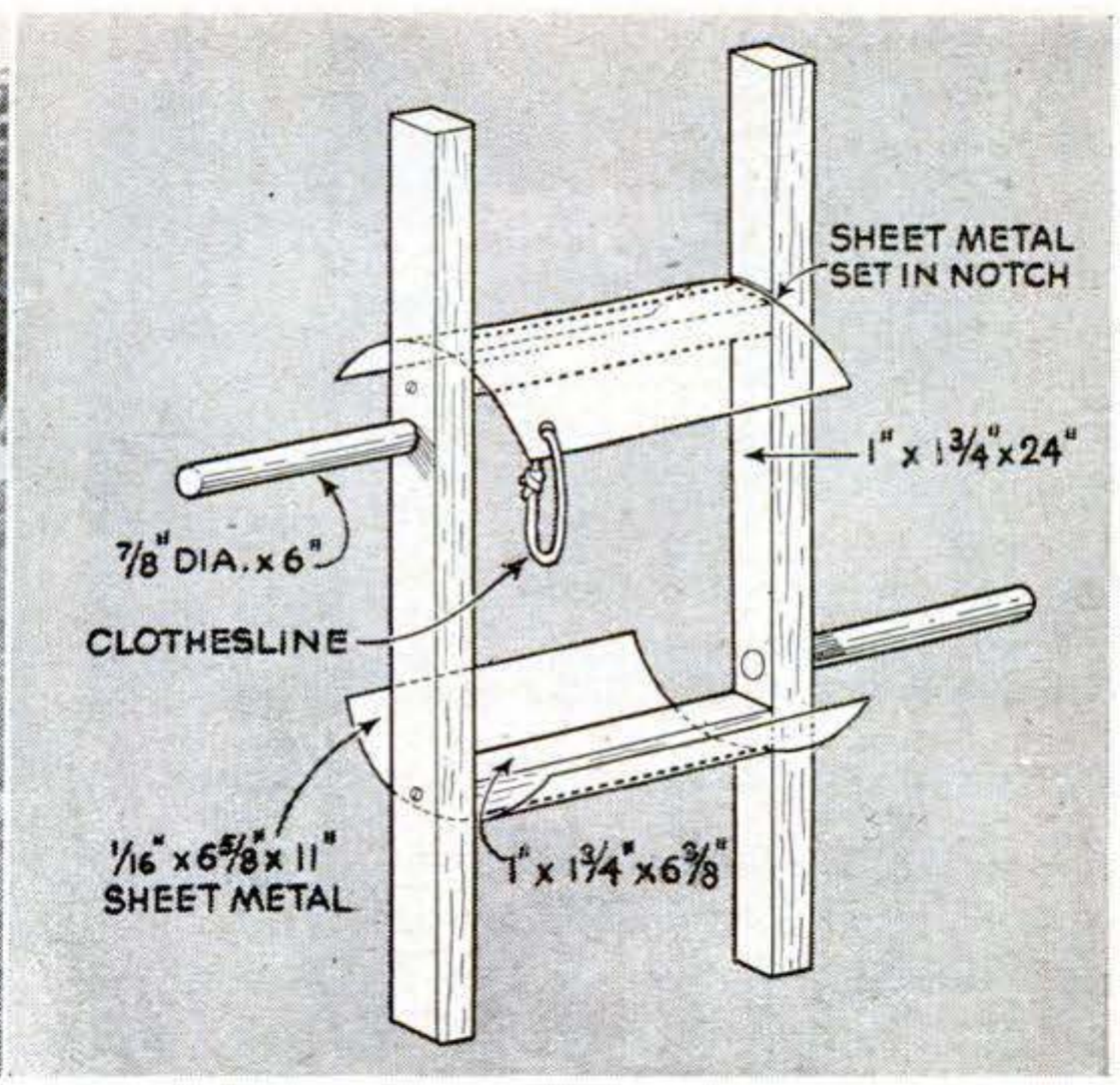
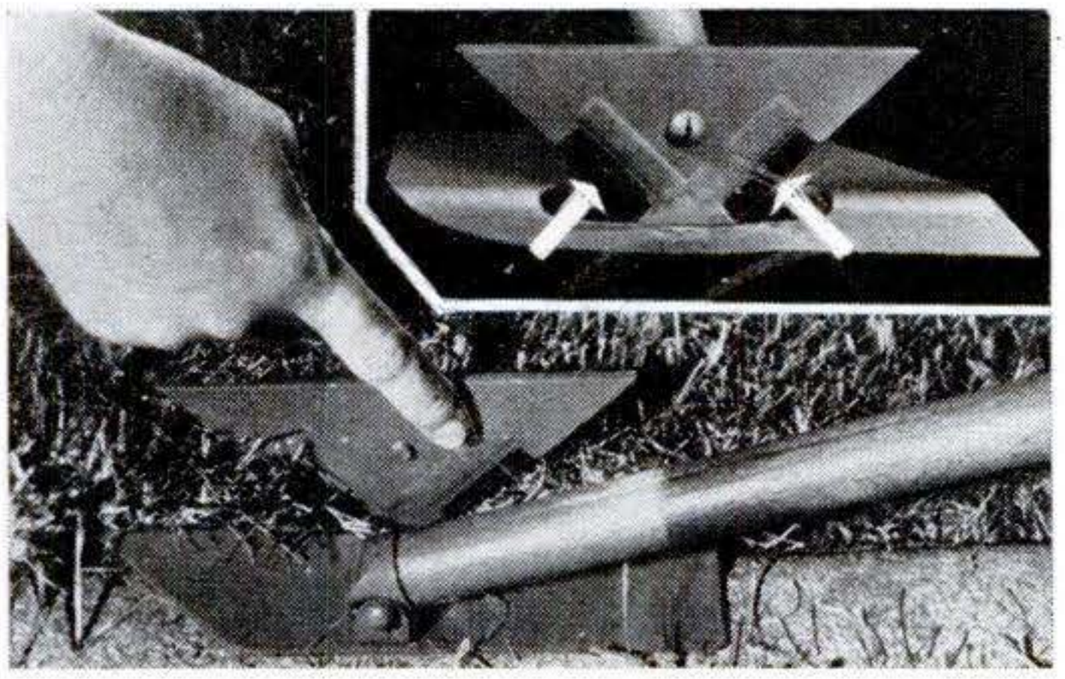


Reel Stores 100′ of Hose

HANDLING and stowing garden hose is simplified with this lightweight reel. To wind up the hose, first attach the nozzle by the rope loop. Then rotate the reel as shown in the photo. Of course the dimensions may be altered, but remember that the overall length of the reel is limited by the reach of your arms. Instead of the sheet metal indicated in the drawing, you can use old license plates, but file off any sharp edges. The handles can be cut from a shade roller or broomstick.—*W. E. Stephens, Belmar, N. J.*

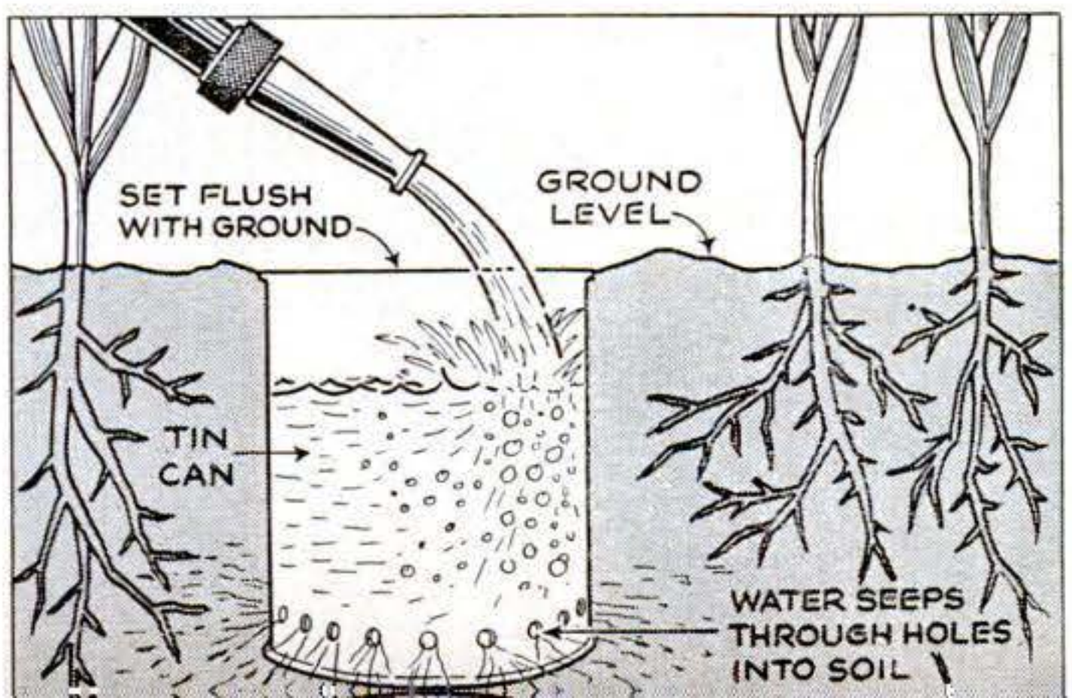


Old Razor Blades Trim Grass

MOUNTED on a 48″ handle, this lawn edger holds two single-edge razor blades at opposing 45-deg. angles. A turn of a screw loosens the plate to replace the blades. In use, the flat plate engages the edge of the sidewalk and the edger is pulled or pushed. The triangular vertical plate pulls the grass down under the blades and the pointed sidewalk plate raises the grass. Commercial Mfg. Co., Chicago, is the maker.

Tin Can Waters Plant Roots

Too much water sprinkled on flower beds tends to run the soil particles together, causing it to bake hard afterwards. A large can, with holes punched near the bottom and set flush with the surface of the bed, gets the water down into the soil around the roots where it's needed. The surface soil is left loose.—*P. R. Wilson, Brooklin, Ont.*



Timing Valve Shuts off Water

SET for the length of time you want the lawn sprinkled, this valve can be left to shut off the water while you go about other business. The adjustment at right lets a trickle of water into a cylinder, slowly forcing a piston down into a valve seat to turn off the water to the sprinkler. Opening or closing the adjustment sets the time. Watermiser Co., Belmont, Calif., makes it.

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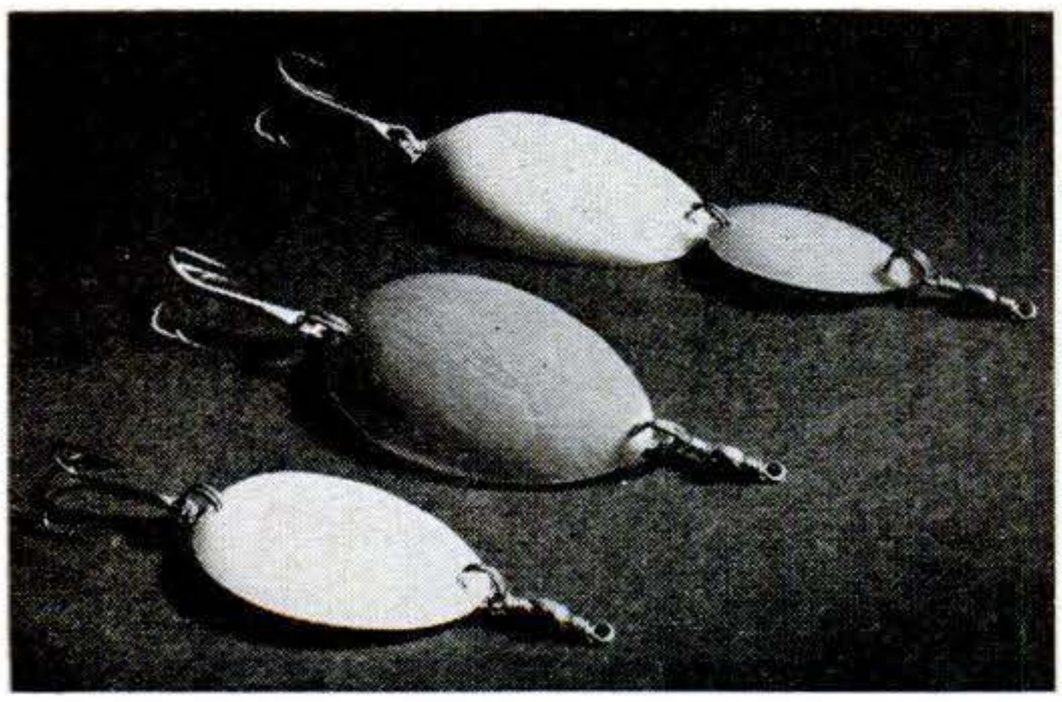
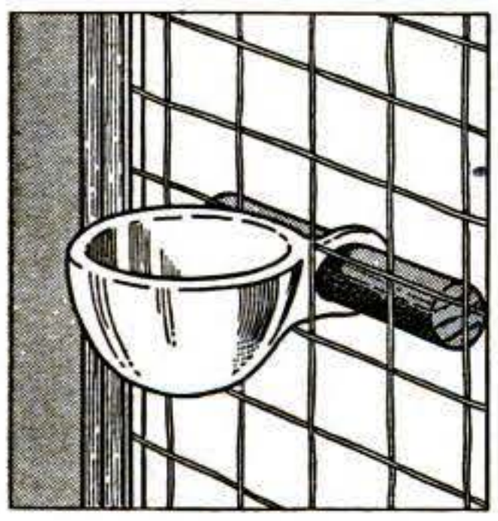


Plastic Spoons Make Lures

COLORED fishing lures can be cut from dime-store plastic spoons or tableware. Saw the handle off the spoon and smooth down the bowl part with sandpaper. Then drill holes at each end—one for a link and swivel and the other for a link and hook. The lures shown above are fitted with No. 3 treble hooks. If you use a plastic tumbler or dish, cut out a blank and gently clamp it between two metal spoons. Place the assembly in boiling water and gradually tighten the clamp as the plastic becomes pliable. This will shape it to the spoons. Then sand it and drill it.—*A. E. Kurth, Detroit.*

Rabbits Feed from Coffee Cup

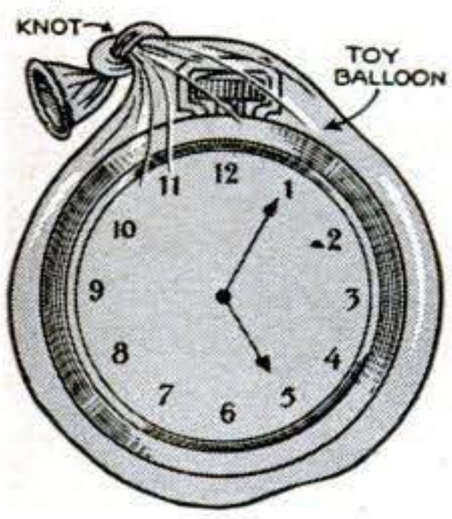
A 10-CENT coffee cup, secured to the wire mesh by a wooden plug through the handle, makes a simple feeder a rabbit can't upset.



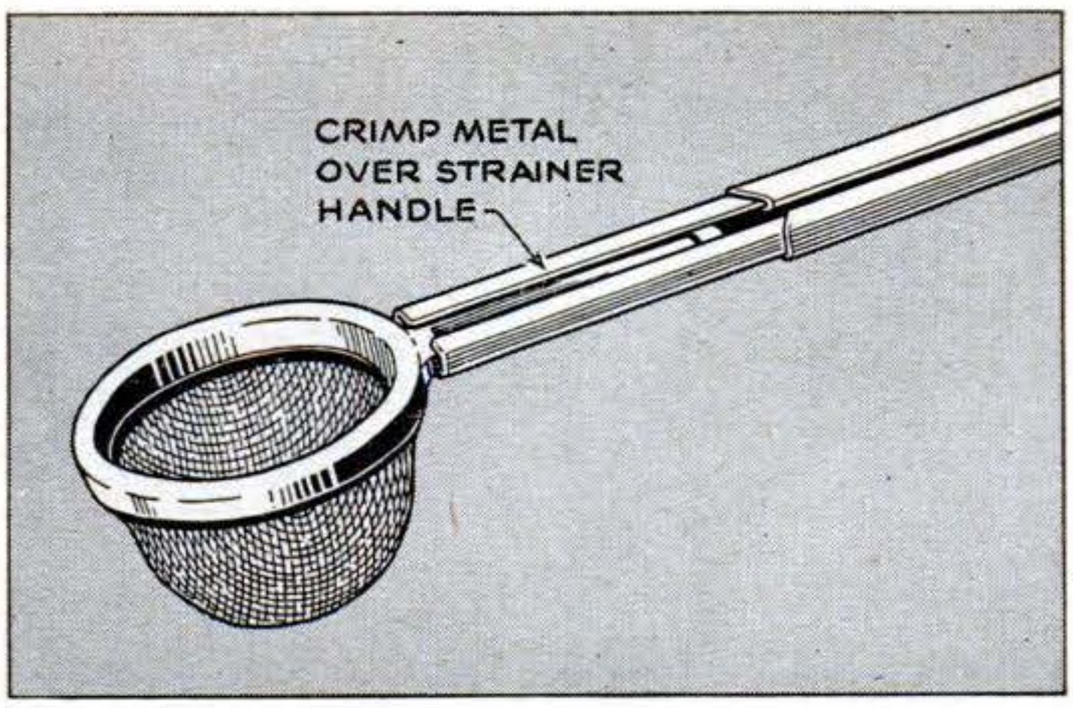
Push the handle through a mesh and then insert the plug. Whittle the plug for a tight fit so the cup won't wobble or tend to turn to one side. —*George C. Throop, Syracuse, N. Y.*

Balloon Waterproofs Watch

YOU can safely carry your watch on camping and fishing trips if you'll slip it into a toy balloon. Tie the balloon's neck in a



knot to seal it against moisture. A balloon is so thin that it's transparent when stretched tightly, and you can read the face of the watch through the rubber.—*R. A. Jenkins, Los Angeles.*

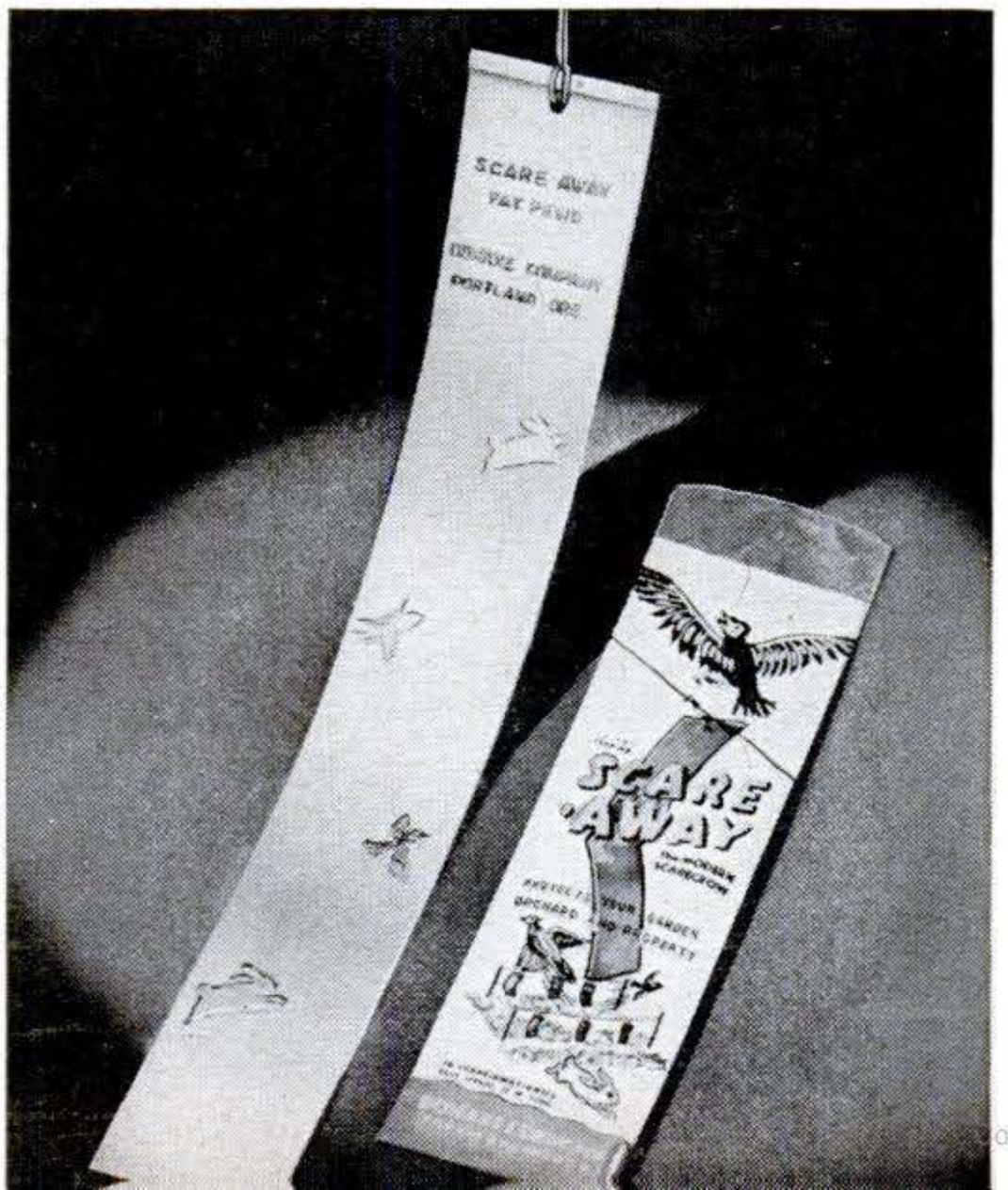


Strainer Retrieves Golf Balls

I MADE a simple, serviceable golf-ball retriever from a small kitchen strainer and a flat, telescoping curtain rod. Carried in my golf bag, it gets balls out of water and from under bushes. Saw the curved ends off the rod and remove the wooden handle from the strainer, leaving the two wires that were inside the wood. Then force the wires into one end of the smaller section of the curtain rod. Crimp the edges of the rod over the wires to lock the strainer in place. Use a painted curtain rod and you won't be bothered by its rusting.—*Arthur Trauffer, Council Bluffs, Ia.*

Aluminum Strips Scare Pests

CALLED Scare-Away ®, these specially treated aluminum strips keep birds and small wild animals out of the garden. The strips, 15″ long, are hung over the area to be protected. They flutter in the lightest breeze, flashing light and making a tinkling noise. The most common uses of the strips are protection of newly planted seeds, tender sprouts, ripe berries, fruits, and vegetables. The maker is Donaxe Co., Portland, Ore.



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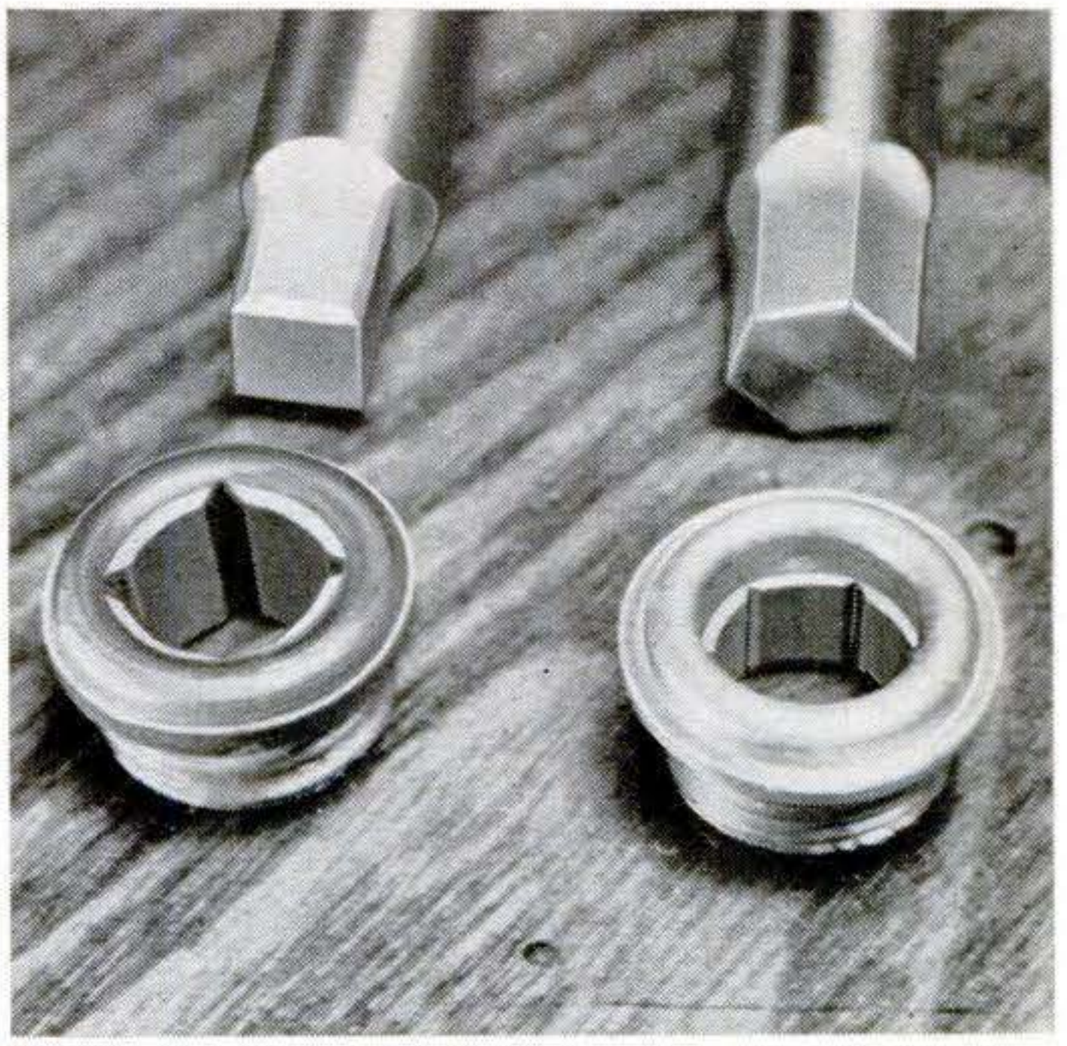
New Valve Seats End Faucet Drips

YOU can stop a dripping faucet with a new washer—sometimes. But if the valve seat is rough or grooved, chances are a new washer is only a temporary cure, and it may not stop the leak at all. Since most faucets today have removable seats, it's easy to change them with this simple tool. New seats can be bought at hardware stores or plumbing shops.

Grind the tool from a 6″ section of ⅜″ drill rod or a piece of iron rod the same size. Since drill rod is much tougher, it will give you a more permanent tool. The holes in seats usually come in two standard shapes —hex and square. So grind one end of the rod for a ⅜″ hex hole and the other end for a ¼″ square hole.

To use the tool, first shut off the water supply and remove the valve stem. The stem will screw out of the valve body after you've unscrewed the nut just under the faucet handle. On many faucets, the nut, handle, and valve stem come out together. Don't disturb the packing under the locknut.

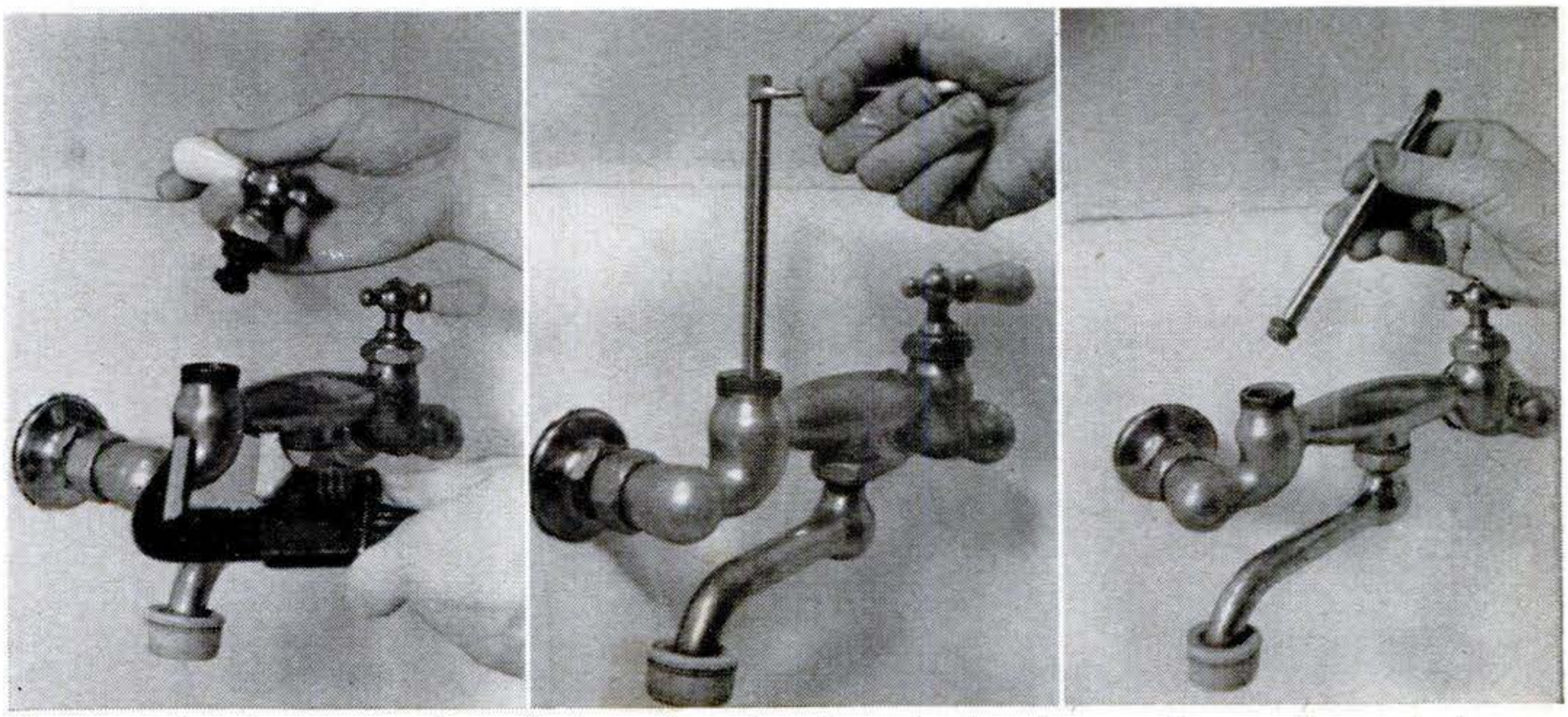
Now insert the seat-removing tool in place of the stem and use a wrench or pliers on the other end of the tool. Turn it counterclockwise to unscrew the old seat.



Two common kinds of removable valve seats are seen here, with square and hex center holes. Homemade tools to remove them are above.

Slip the new seat on the end of the tool and screw it in place fairly tight, but don't overdo it. Replace the stem, tighten the nut, and the valve is as good as new. While you have the faucet apart, it's a good idea to replace the washer if it's worn.

When a faucet leaks around the stem, it needs new packing. Slide up the nut to add more, or pull out the old and replace it with new. To reset the handle at a convenient angle, remove the top screw, pull off the handle, and replace on the splines as desired.—*William E. Danneman, Chicago.*



Here are the three steps in replacing a faucet seat. First use a wrench to unscrew the nut under the faucet handle. Then screw the stem out by turning it as you would to let water through the faucet. Insert the tool (center photo) and with wrench or pliers, turn it counterclockwise to unscrew the seat. Slip a new seat on the tool and thread it in place.

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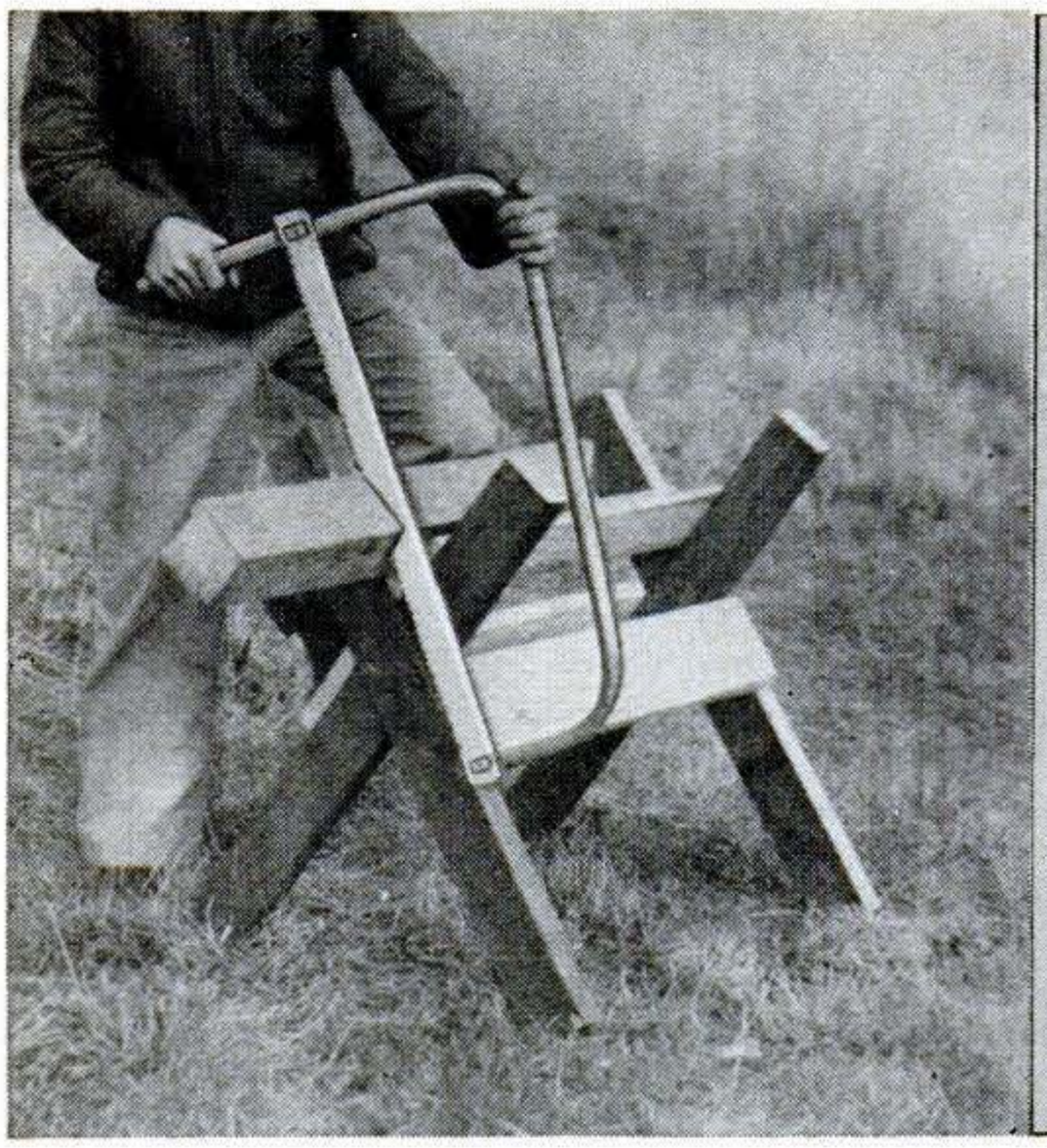
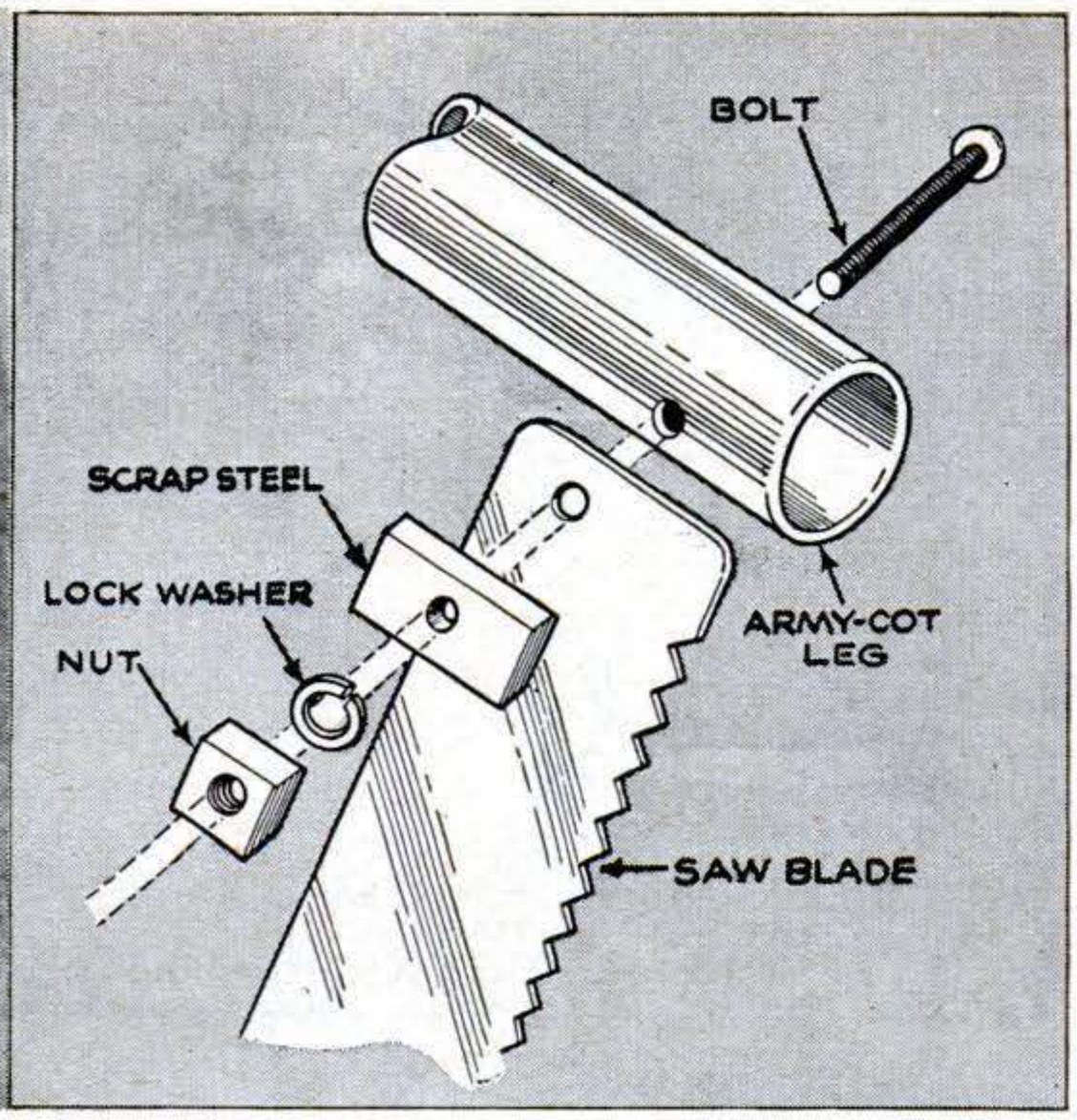
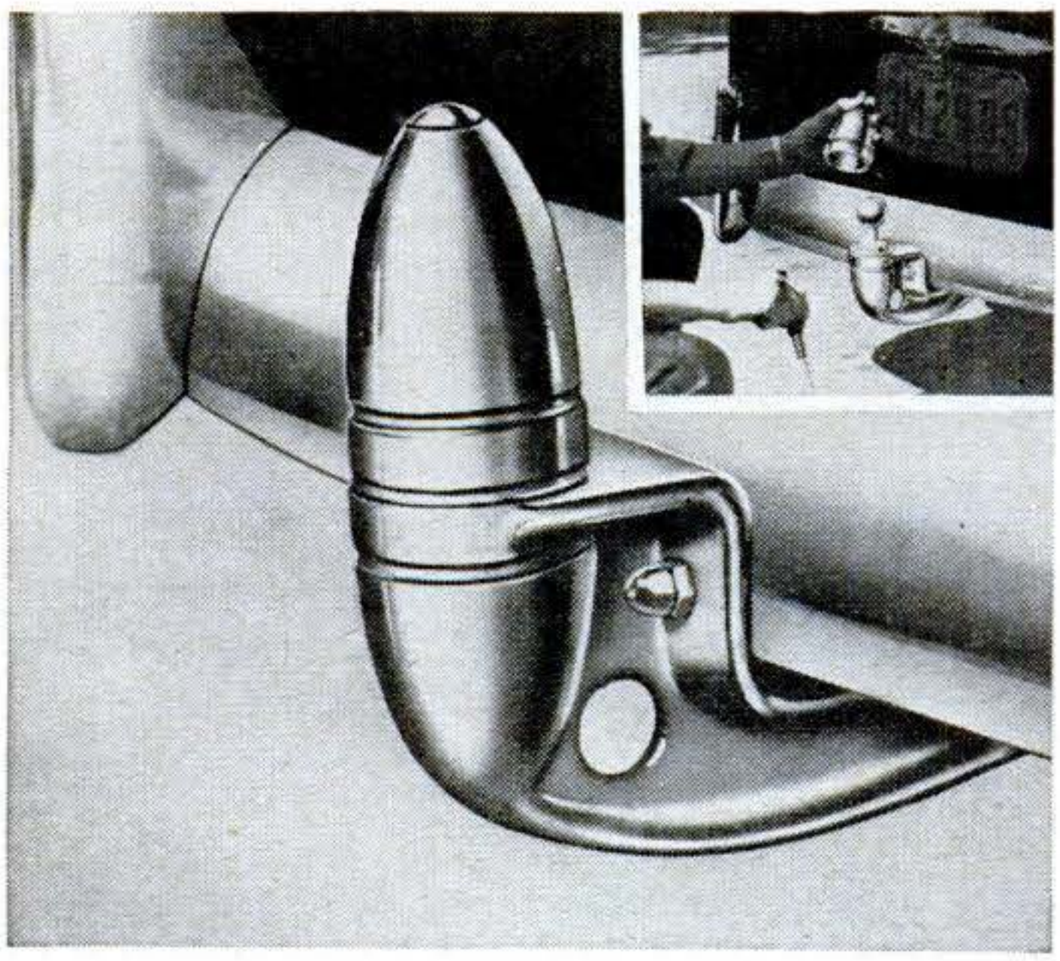




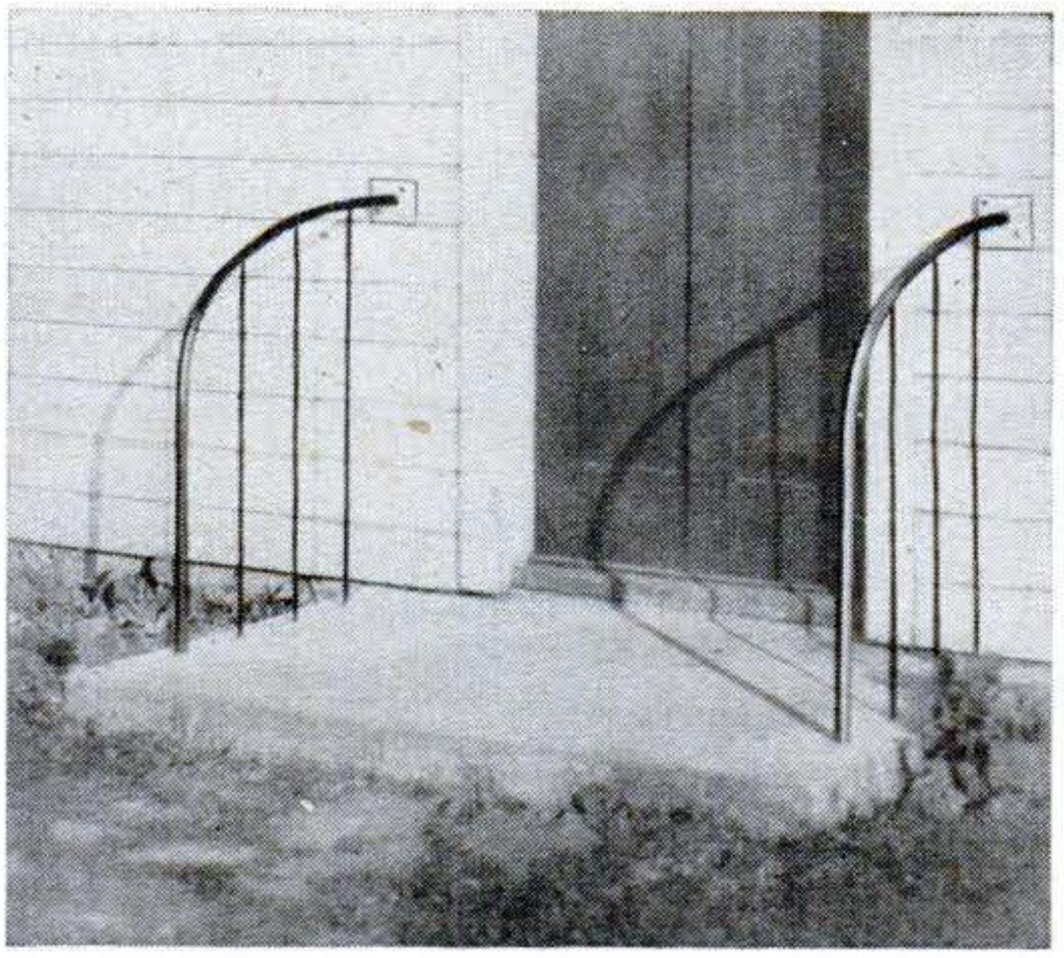
Bucksaw Frame Cut from End of Old Metal Cot

You can make a new frame for your bucksaw by cutting down the end of a metal cot and drilling it to take the blade. I picked up the end of a tubular steel cot at a junkyard. Lay the blade across the frame and mark the hole locations. Then spring the frame to provide proper blade tension. Saw off one end as shown in the photo and drill ¼" holes. Fasten the blade on with ¼" by 1½" stove bolts, using plates cut from scrap to hold it tightly against the frame.—*Ralph S. Wilkes, Keuka Park, N. Y.*



Trailer Hitch Is Streamlined

MADE of chrome-plated cast steel, the Husky Hitch® exceeds drawbar strength requirements by 12 percent, according to the Altadena Products Corp., Altadena, Calif. The cap of the hitch covers a rustproof ball. Custom designed to fit various makes of cars, the hitch has smooth lines to eliminate soiling or snagging of clothing and danger of injuries from sharp projections. When not in use, it acts as a bumper guard.



Railings Made from Steel Bed

ORNAMENTAL hand railings for porches and stairs may be made from the heads of old tubular steel beds. Saw the head in two in the middle and use a half on each side of the steps. The lower ends of the one shown here were set in concrete. The top ends are held in place by blocks screwed to the siding. Holes were bored in the blocks to accommodate the tubing, and the railings were painted.—*Mrs. Clare Wilkes, Cato, N. Y.*

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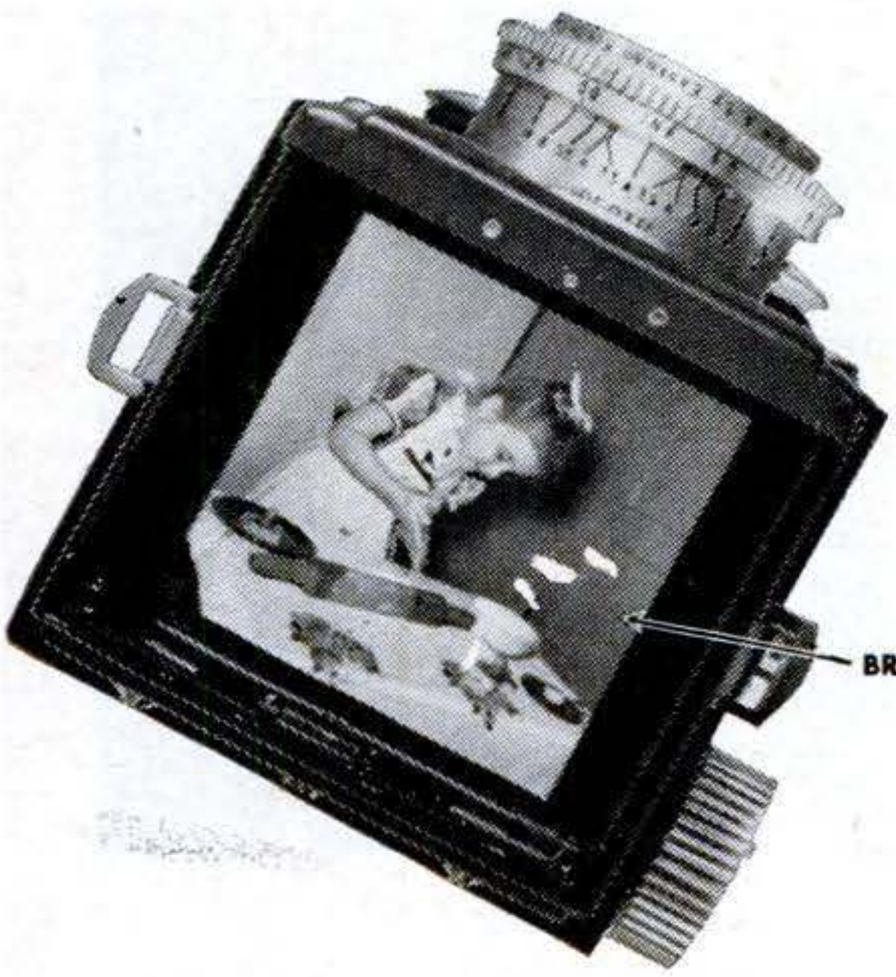
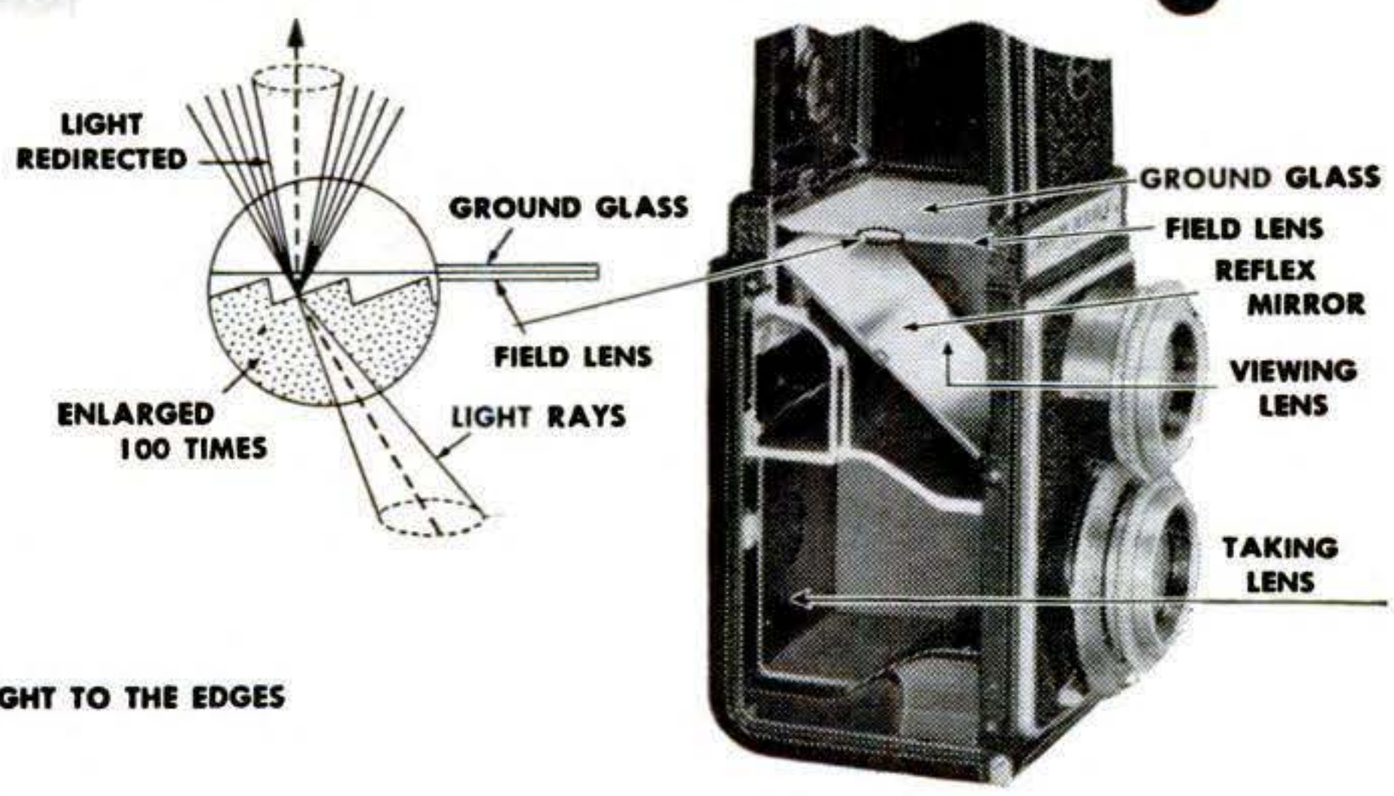
See the image 2½ times as Bright





SPARKLING BRIGHT describes the image you see in the finder of the new Kodak Reflex II Camera. Sharper focusing, edge-to-edge composing are made possible with the new Kodak Ektalite Field Lens beneath the ground-glass screen (see diagram above). Microscopic lens grooves redirect stray light rays—give you an image *2½ times as bright overall, 10 times as bright at corners,* as with the usual ground-glass finder.

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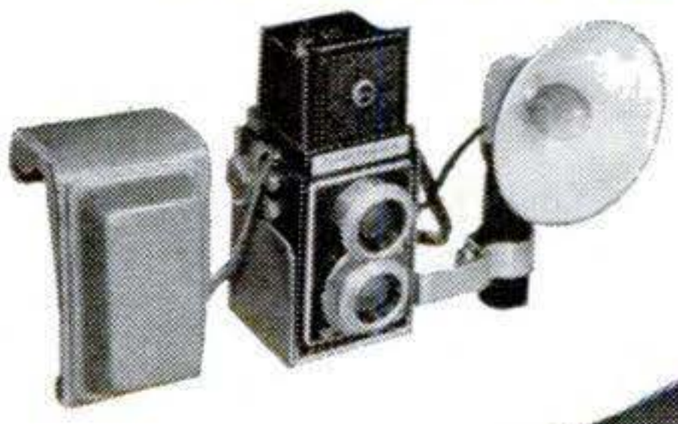

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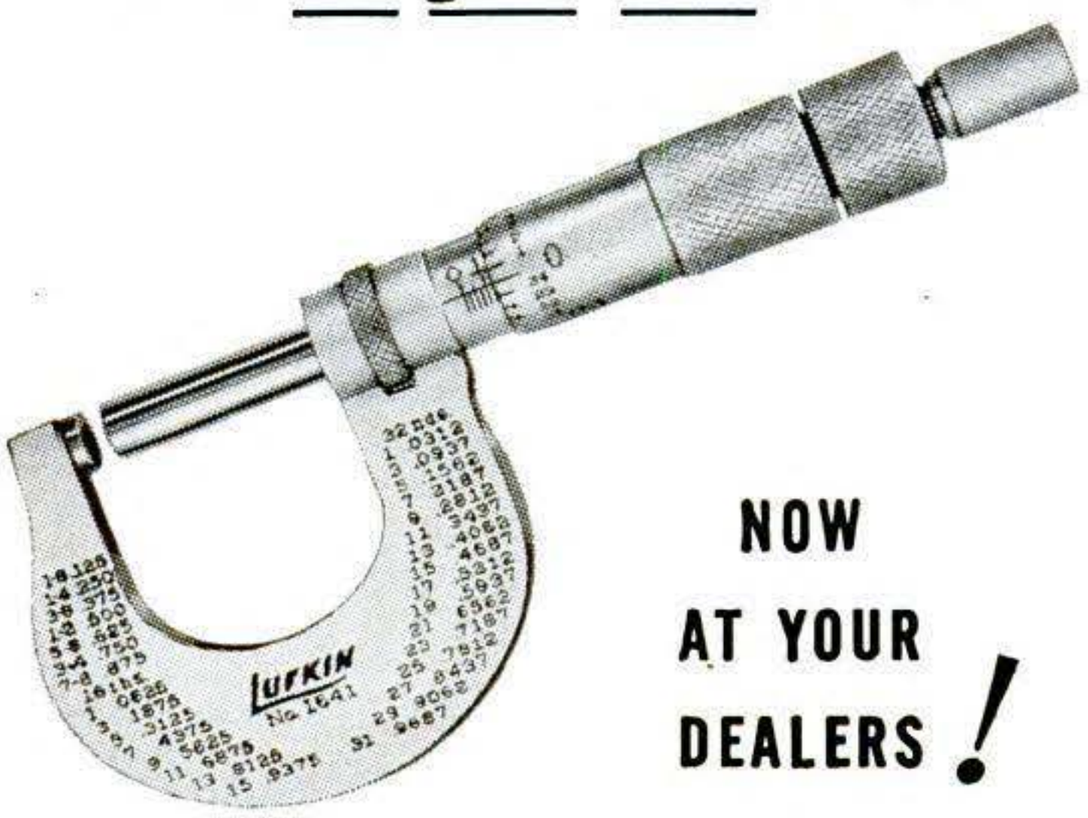

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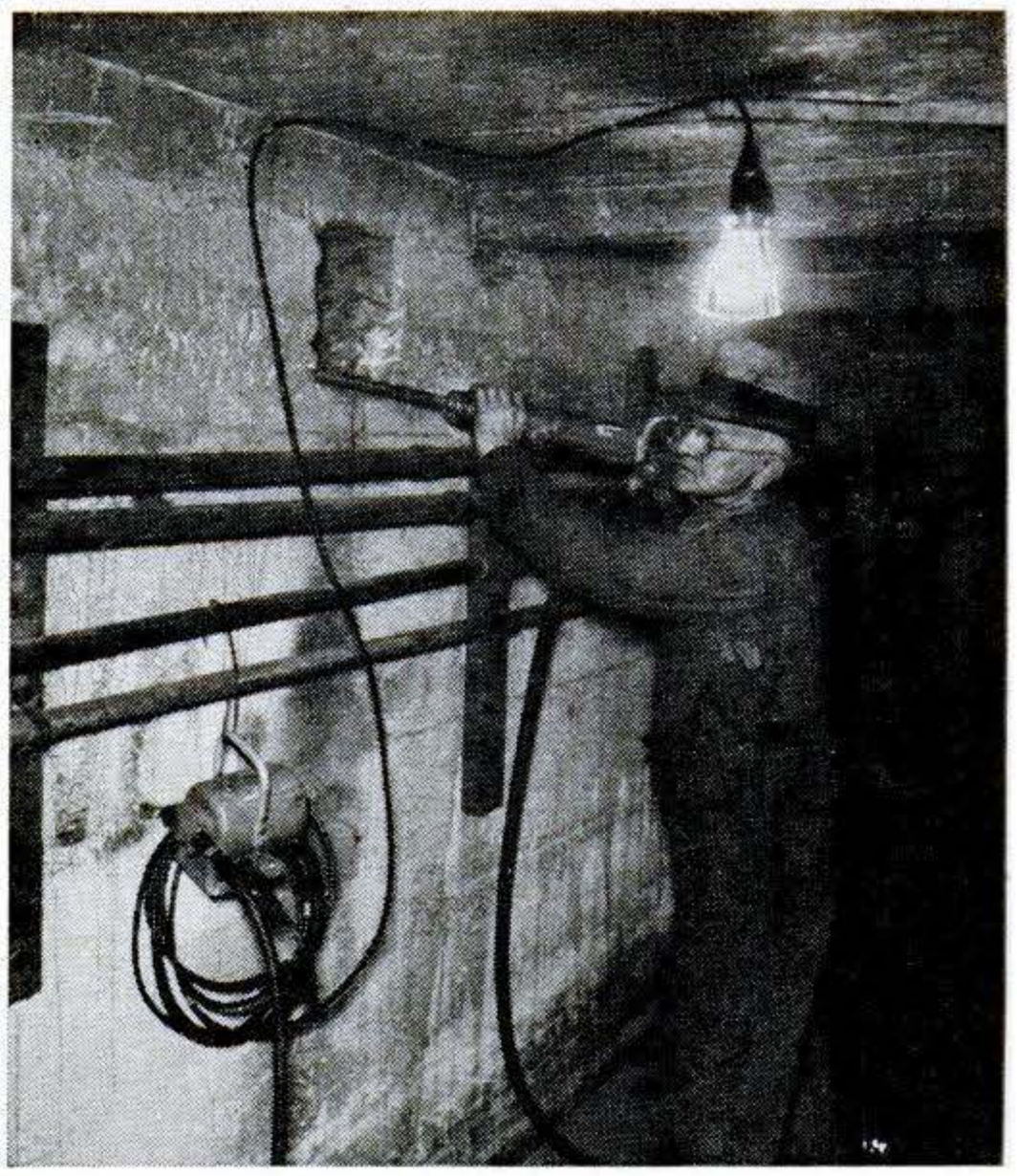

Air Runs Generator

THE portable electric generator hanging at left above supplies light to underground workers from the same compressed-air power line that runs their tools. Weighing 8¾ lb., Airlite® can operate two 75-watt bulbs. The manufacturer, Ingersoll-Rand Co., of Phillipsburg, N. J., says the generator cannot be damaged when its terminals are accidentally shorted; light comes on again when the short is removed.

Chess Set Made of Plastic

THESE smooth-lined, artistically formed chessmen should please chess fanciers. Created by Peter Ganine, sculptor and design consultant, they are made of red and black Bakelite® phenolic plastic. The pieces are lightweight and said to be practically nonbreakable. A carrying case comes with the set, which is nationally distributed by Zacho, of Los Angeles. In the luxury class, the chessmen retail for about $75.

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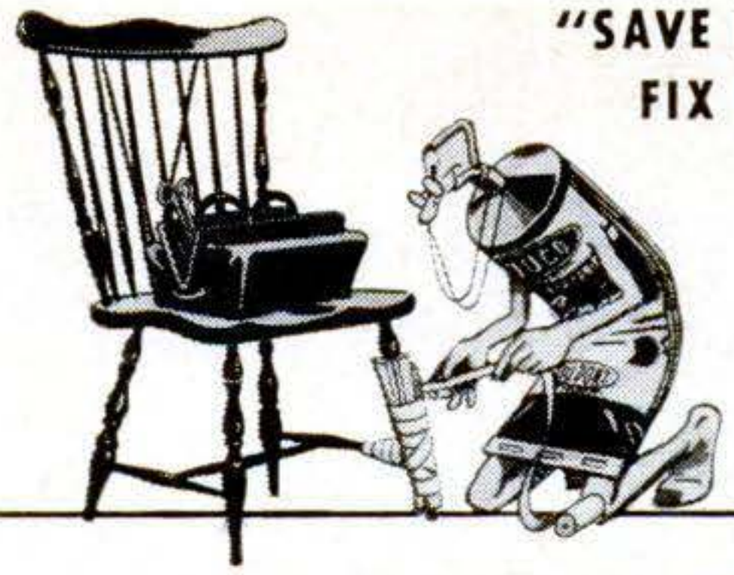

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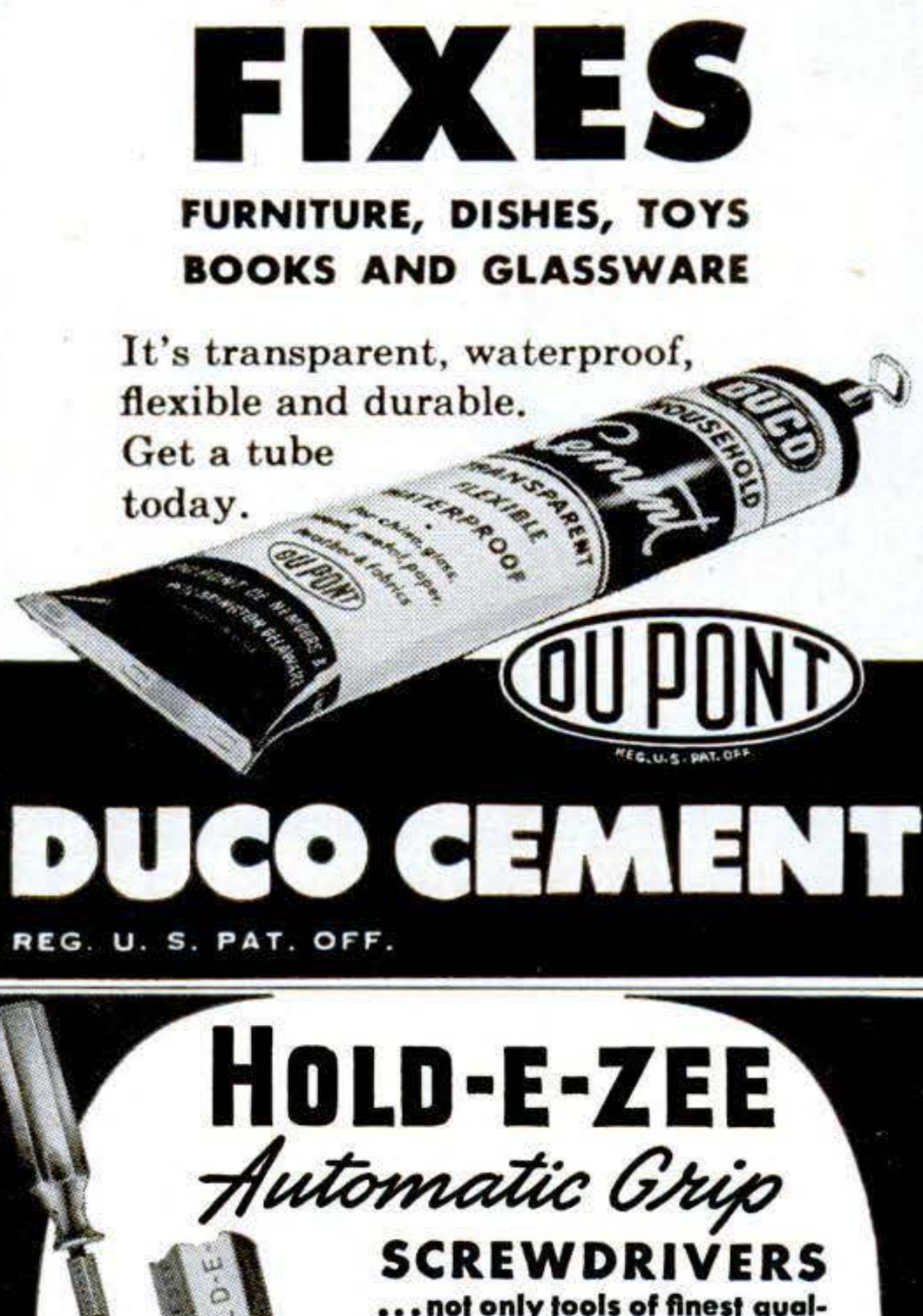

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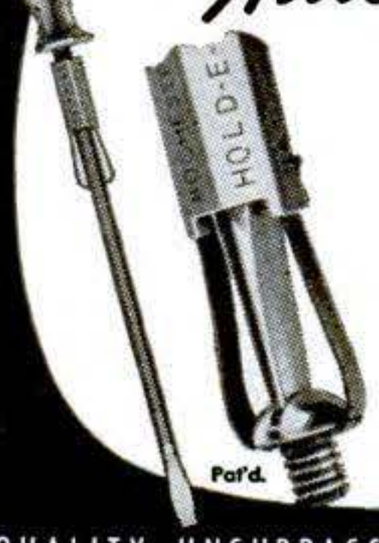

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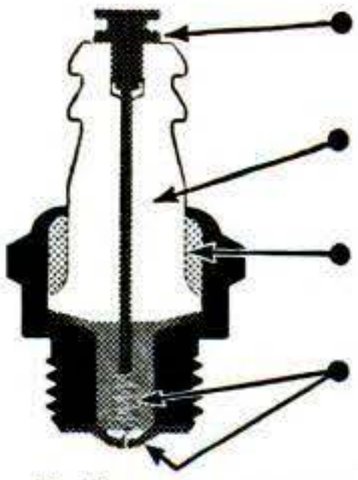

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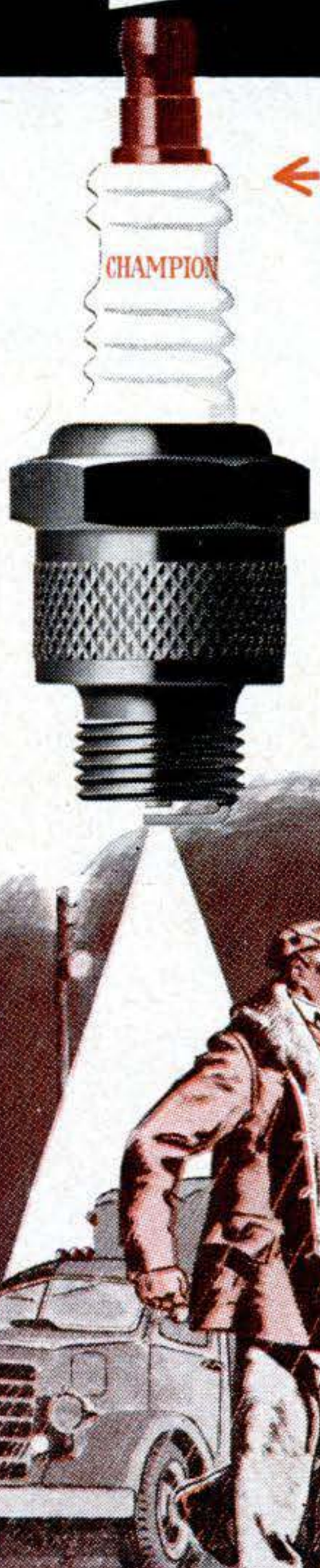

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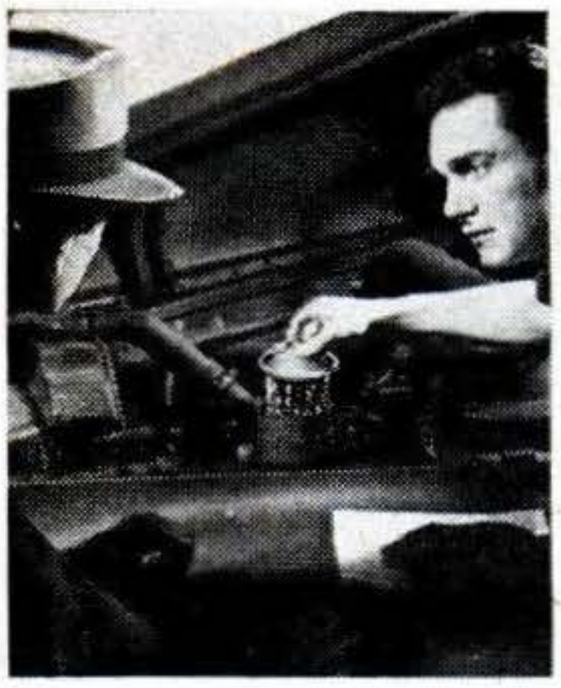
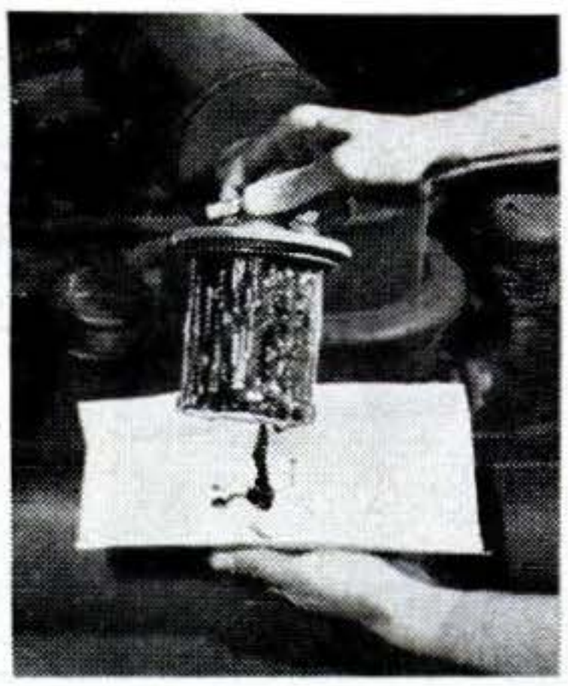


WINTER DRIVING GUMS UP YOUR ENGINE... dangerously clogs up your oil filter.



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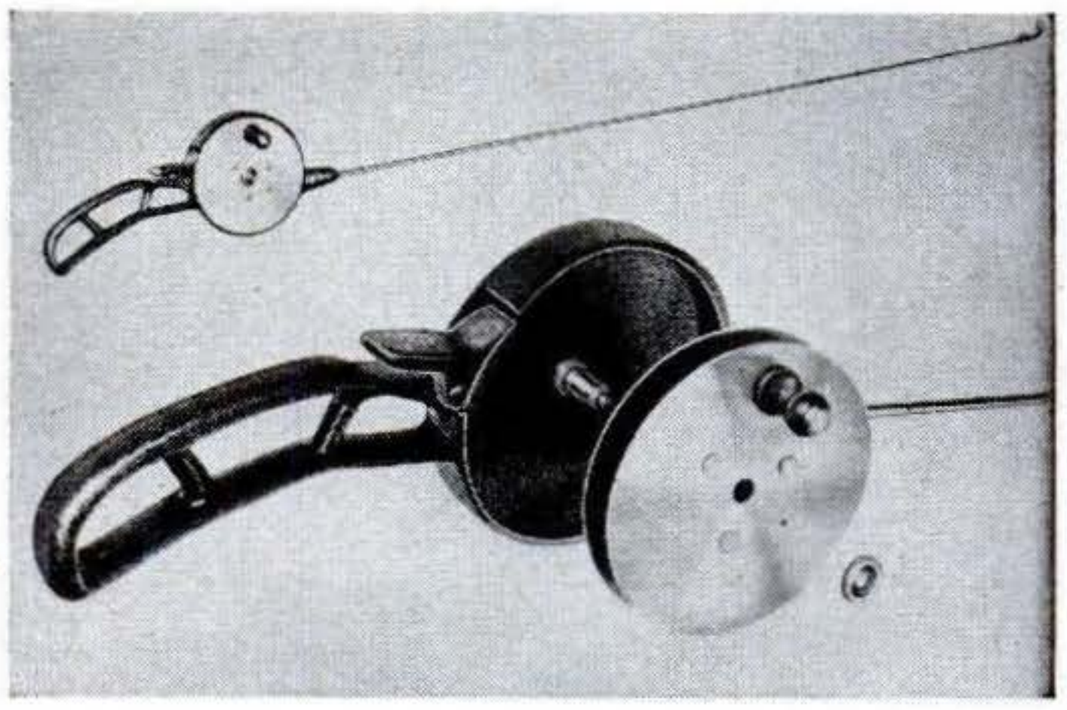

Rod Has Gunlike Grip

THIS simple casting rod for novice fishermen has a gun-shaped, cast-aluminum handle with a built-in holder for interchangeable reels. A snap-on reel fastener lets a fisherman quickly change from one line to another. Called the Handy Dandy®, the rod is oil-tempered and comes in 32- and 44-inch lengths. Made by the Nu-Toy Manufacturing Corp., of Detroit, the rod has a special carrying case.

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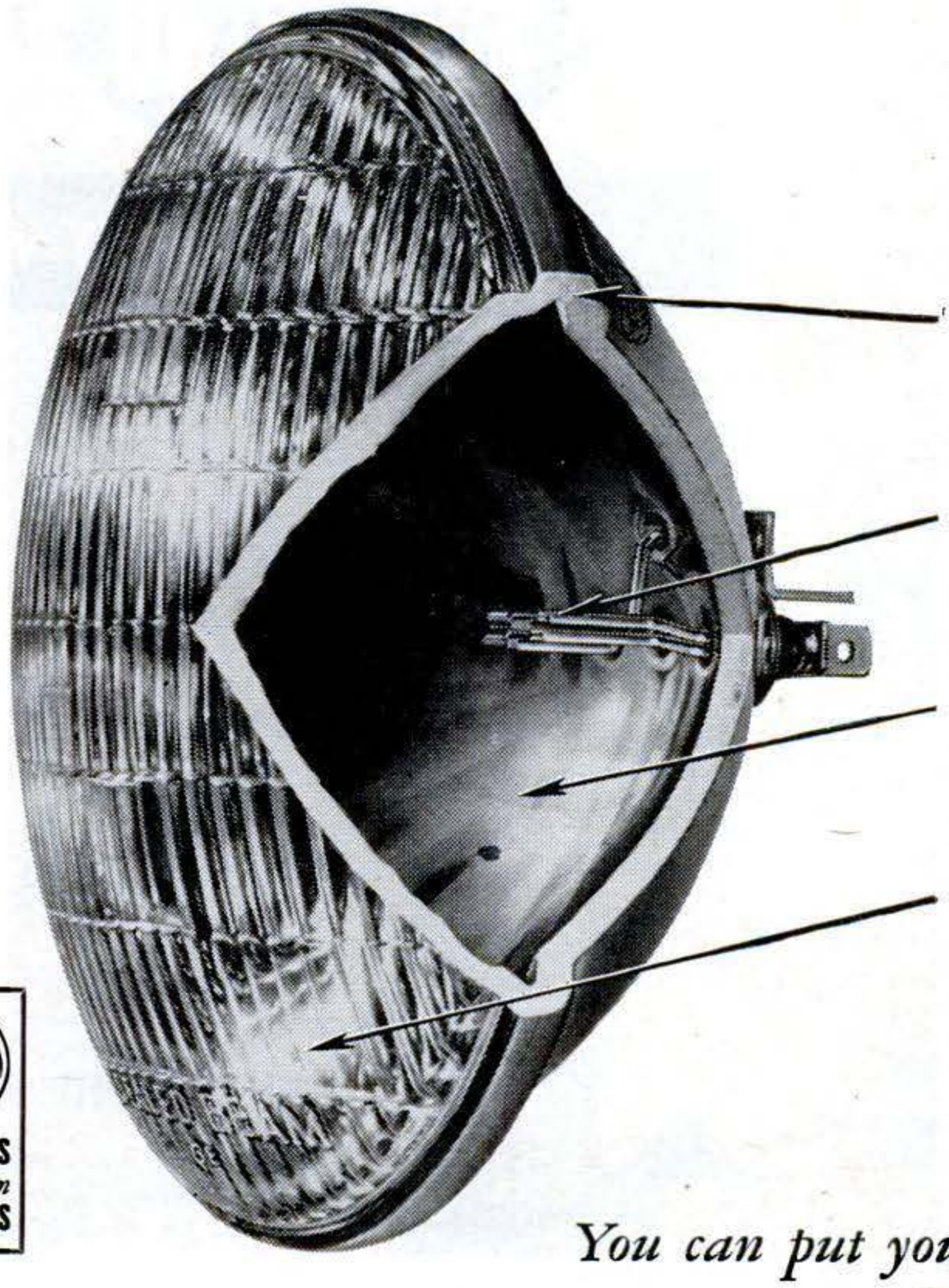

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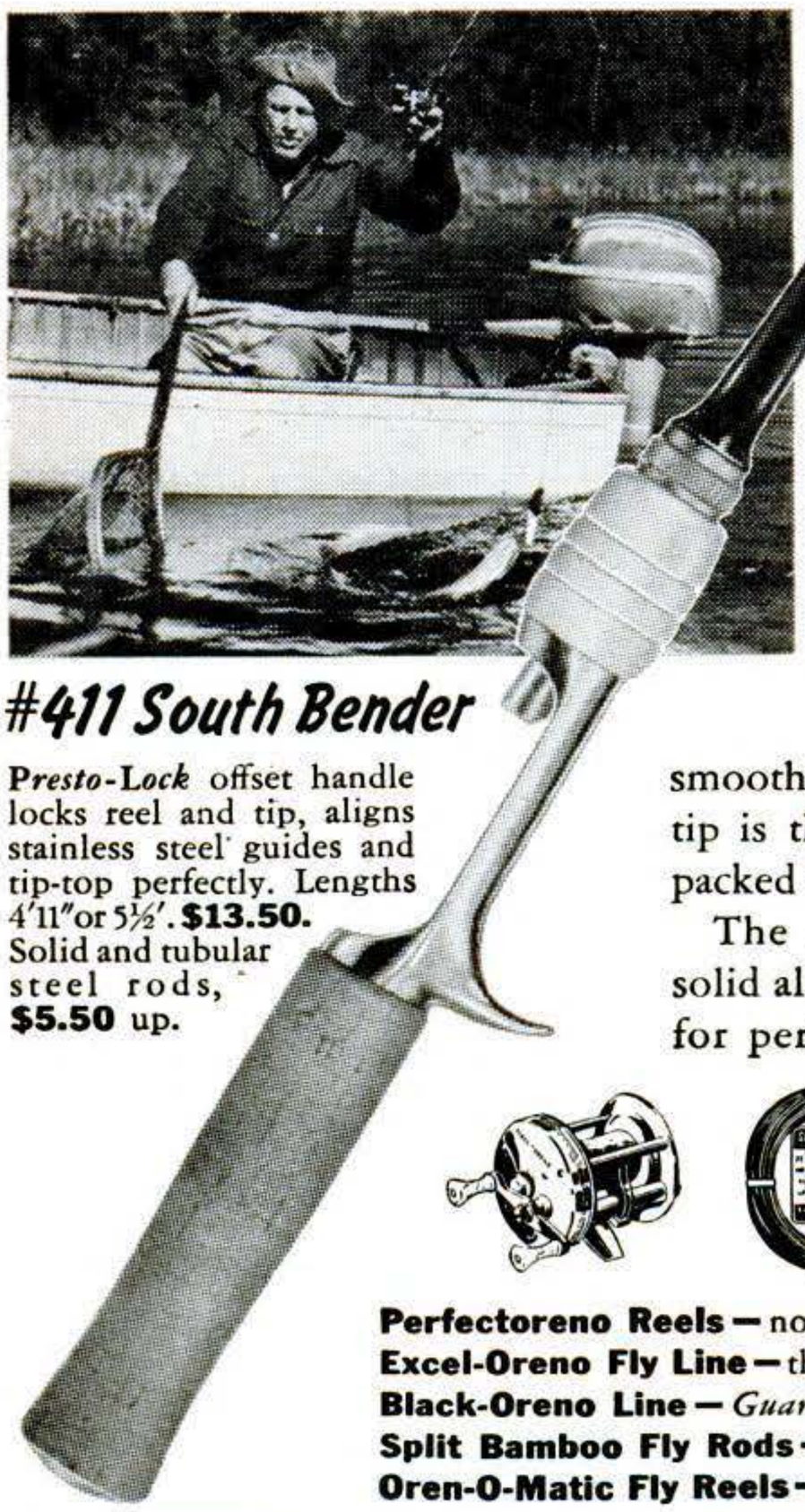

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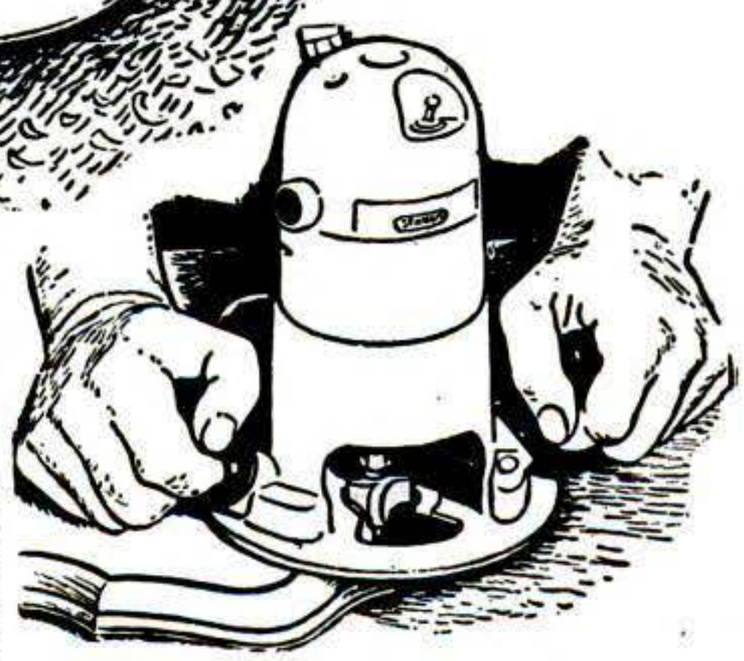

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Piston Rings need replacing, too!

OIL-PUMPING in your car warns that you need new piston rings. It's the *first* sign of worn-out rings and the danger signal of undue engine wear.

Fortunately, rings are easily replaced. And when you replace with Hastings Steel-Vent piston rings, you *stop* oil pumping, *check* cylinder wear and *restore* performance. It's the best money you can spend on your car. Hastings Manufacturing Company, Hastings, Michigan, Hastings Ltd., Toronto.

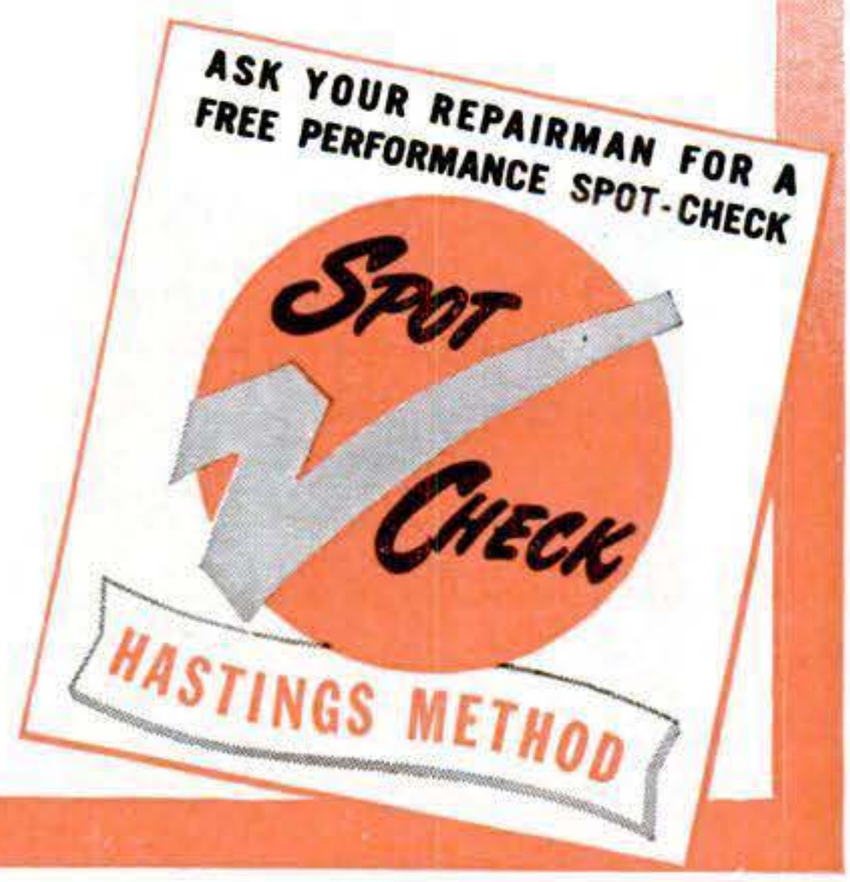
HASTINGS

STEEL-VENT PISTON RINGS

"TOUGH . . . BUT OH SO GENTLE"

TOUGH *on Oil-Pumping*

GENTLE *on Cylinder Walls*



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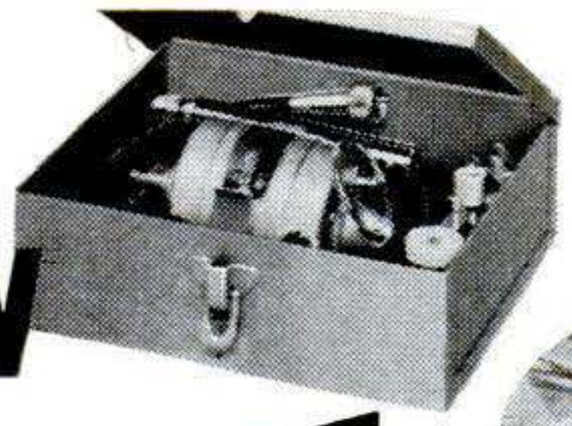
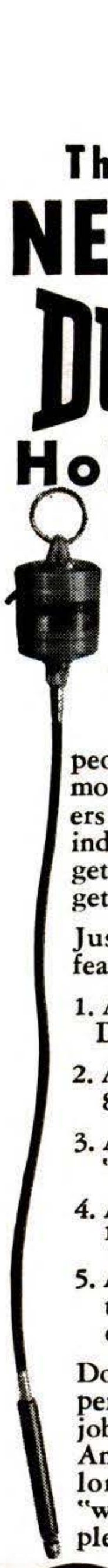


The
NEW DUMORE
Hobby-Flex



. . . a genuine Dumore flexible-shaft tool for faster, easier hobby-work

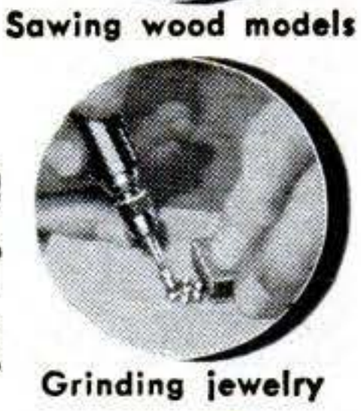
The new Hobby-Flex is "made to order" for you. And it's made by the same people who produce the famous Dumore precision grinders and flexible-shaft tools for industry. So you know you're getting the *finest* when you get a Hobby-Flex!

Just look at these special features:

1. A vibrationless 1/20 hp Dumore motor (15000 rpm).
2. A durable 36" flexible shaft; 8-foot cord.
3. A pen-size handpiece for "close control" on fine work.
4. A chuck that takes both 1/8" and 3/32" tools.
5. A handy hanger-ring to hold the motor on a hook or overhead pipe.

Doesn't that sound like the perfect tool for hundreds of jobs in any home workshop? And it is. That's why it belongs at the top of your "want" list. Send for complete information.

Sawing wood models



Grinding jewelry

Polishing plastic sculpture

Carving fine woods

Plastic carving

Filing and drilling metal models

Tear out this coupon and mail today!

Sawing	Drilling	Burnishing
Grinding	Routing	Cleaning
Sanding	Finishing	Engraving
Polishing	Carving	Touching Up
Burring	Filing	Shaping

The Dumore Company, Dept. D-52, Racine, Wisconsin

Please send me the items checked below:

☐ No. 19-021 Hobby-Flex, consisting of motor, flexible-shaft, handpiece, and wrenches. $21.50 enclosed.

☐ No. 19-011 Deluxe Hobby-Flex, same as above, plus steel carrying case and 10 accessories. $27.50 enclosed. (Cash or Money-order please. Shipping Charges C.O.D.)

☐ Literature giving complete information.

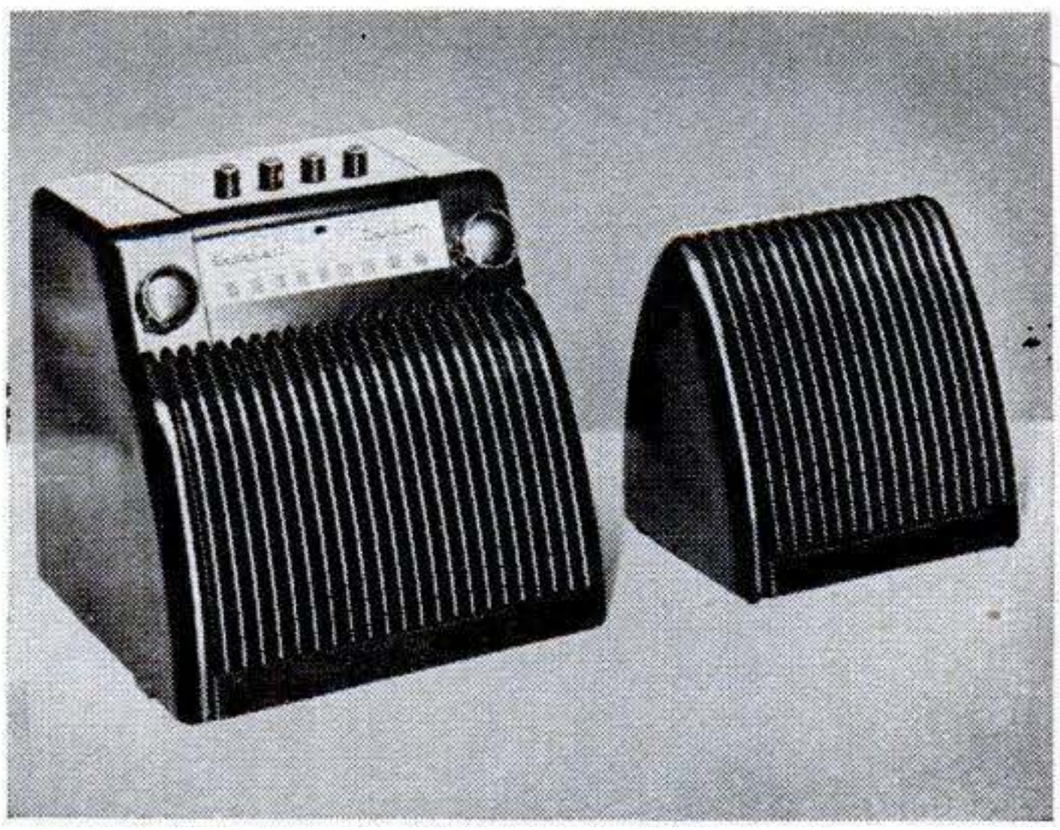
Name_____

Address_____

City_____ (___) State_____

Panel Tests Auto Lamps

THIS new device for use in automobile-accessory stores makes it easy for a salesman to give any size of car lamp a final check before wrapping it up for a customer. Five outlets on a single panel, and a six-volt transformer to vary the voltage delivered to them, can handle a complete line of lamps—from a tiny instrument-panel bulb to a sealed-beam headlamp or spotlight. Westinghouse developed the tester.



Radio Does Double Duty

PUNCHING a button on this radio turns it and the extension outlet at the right into a two-way communications system between rooms. Both the master AC-DC radio and desk extension, connected by a 50-ft. cord, have 5-in. speakers that double as microphones. The outfit, called Radio DorAfone®, is made by Setchell Carlson, Inc., of St. Paul. The matching cabinets come in black or ivory plastic.

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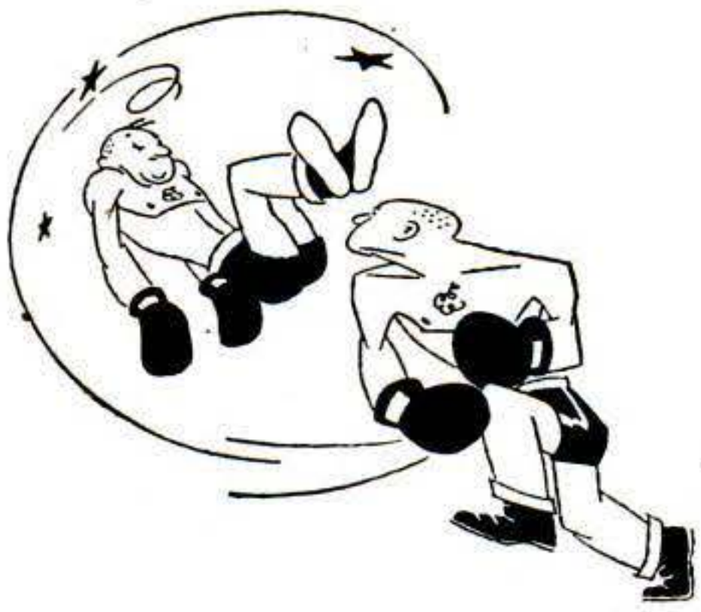
extra punch . . .



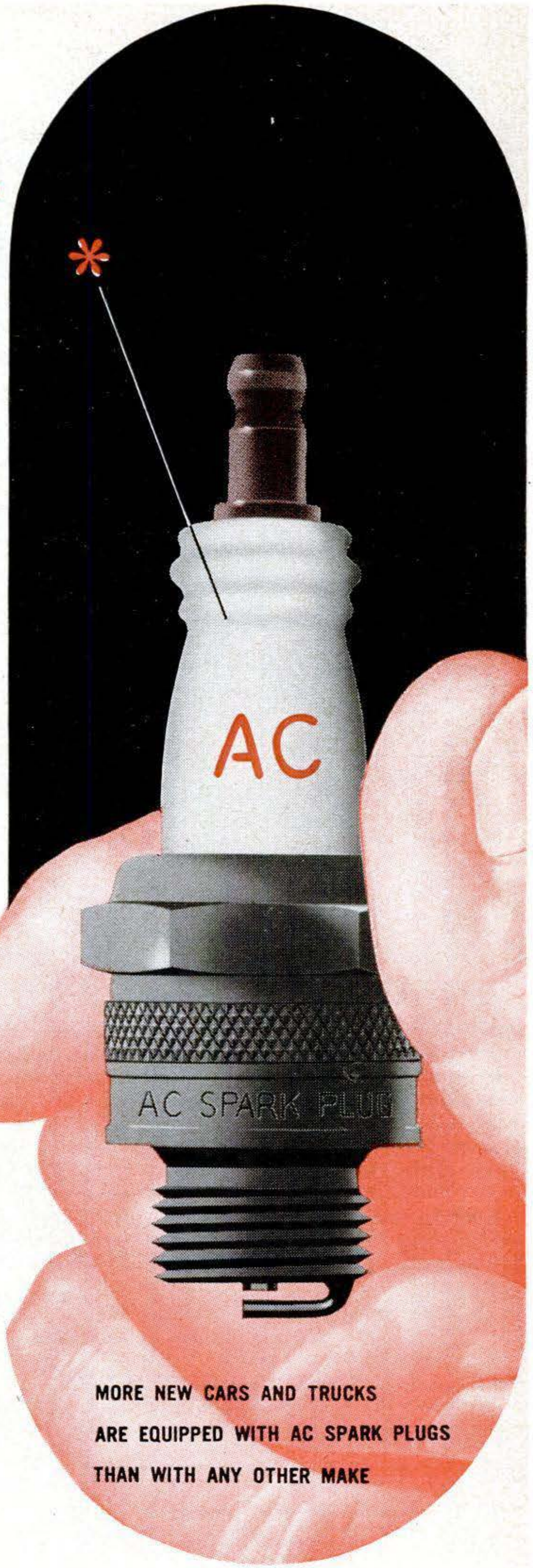
● **Extra punch when you need it.**

When spark plugs become sluggish or misfire under heavy loads, the cause is probably oxide coating on the insulators. To minimize or correct this condition, get a set of new AC Spark Plugs with patented CORALOX Insulator.*

They give you easier starting, better idling, and the extra punch you need for hard pulls or cross-country driving.

They give you the extra mileage that means real economy. And they stay clean and efficient longer.

AC SPARK PLUG DIVISION • GENERAL MOTORS CORPORATION



AC SPARK PLUGS

BUY WHERE YOU SEE THIS SIGN

MORE NEW CARS AND TRUCKS
ARE EQUIPPED WITH AC SPARK PLUGS
THAN WITH ANY OTHER MAKE

* AC's patented processes make Coralox the finest insulator in spark plug history. Improved electrical insulation, no matter how high the temperature. Better heat conduction. Maximum resistance to heat shock. Less fouling. Harder, stronger, longer-lived.

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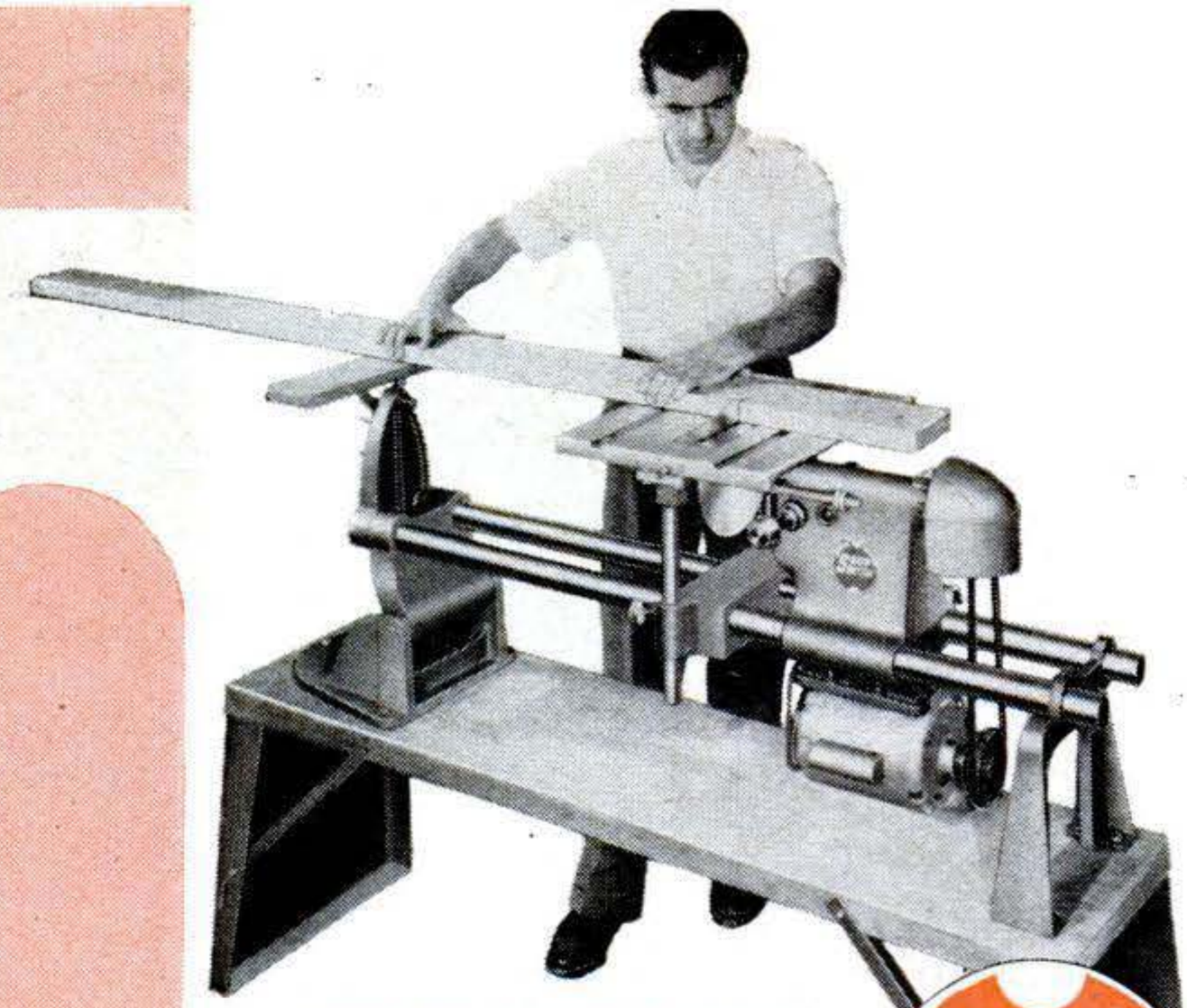
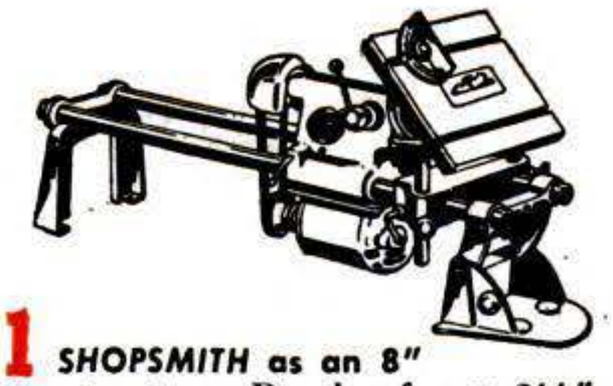


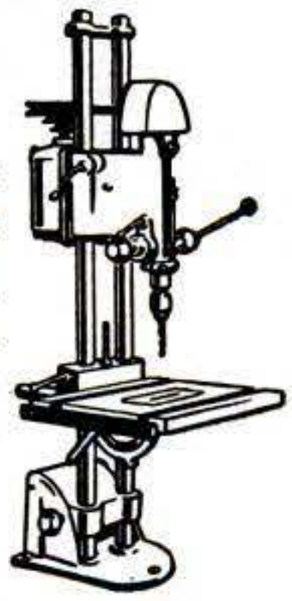
Shown here in use as circular saw, *SHOPSMITH* quickly converts to vertical drill press, lathe, sander and horizontal drill press

SHOPSMITH
REG. TRADE MARK

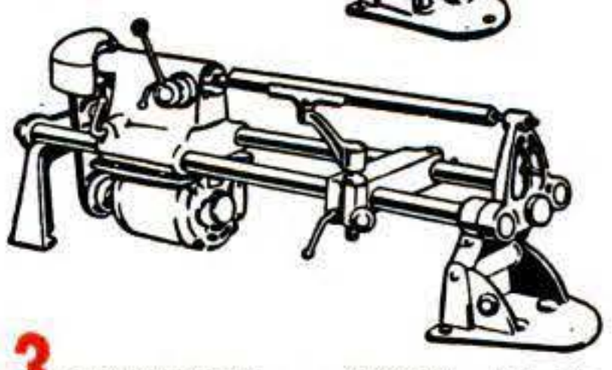
5 BIG-CAPACITY POWER TOOLS IN 1



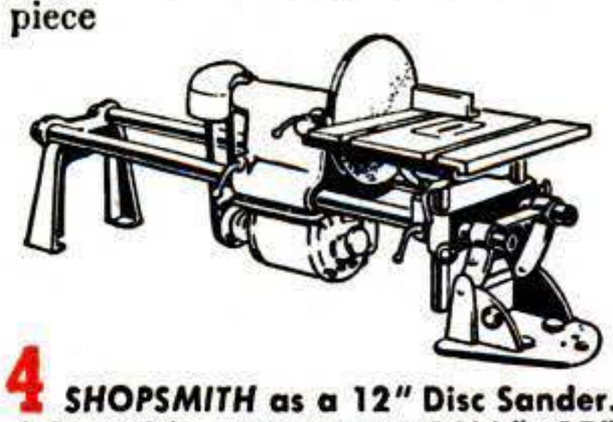
1 *SHOPSMITH* as an 8" Circular Saw. Depth of cut 2¼". Table 14½" x 17"—with extension 54" x 17". Up to 46" between blade and fence. Tilting table



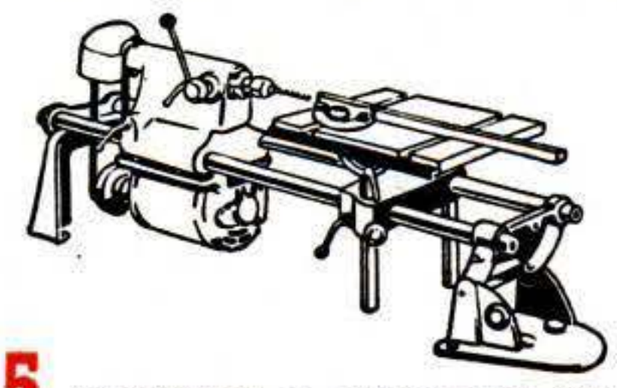
2 *SHOPSMITH* as a Vertical Drill Press. Drills to center of 15-inch circle. 27-inch maximum distance from table to chuck, 4¼-inch feed



3 *SHOPSMITH* as a 34" Wood Lathe. (34" between centers) with a 15-inch swing. Quill feed 4¼ inches. Tool rest always slides parallel to work piece



4 *SHOPSMITH* as a 12" Disc Sander. Adjustable mitre gauge. 14½" x 17" table tilts to 45 degrees. Discs can be removed and replaced in seconds



5 *SHOPSMITH* as a Horizontal Drill Press. Brand-new in the power tool field! Provides accurate drilling for doweling. No limit on length of work

Quick-converting *SHOPSMITH* changes from any one to any other of the five basic power tools shown here in less than a minute. It has greater work capacity *in each position* than comparable single-purpose tools. (*SHOPSMITH* converts also to buffer, grinder, router, drum sander, shaper, mortiser, etc.) *SHOPSMITH* is precision-engineered for accurate work on big or small jobs. Ruggedly built—weighs 200 pounds. You can set up a *SHOPSMITH* in any corner of your basement or garage. See demonstration at any Montgomery Ward store, or your leading hardware or department store. Or mail coupon below for name and address of nearest dealer.

FIVE TOOL UNIT COMPLETE ONLY $159.50

with ½ h.p. ball bearing motor $195.50

MAGNA ENGINEERING CORPORATION
465 California Street—Dept. 24A, San Francisco 4, California
Please send descriptive folder on *SHOPSMITH* and name of nearest dealer

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*City*_____ *Zone*____ *State*_____

—THAT'S SHOPSMITH

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HIGH POWER REPEATERS

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Marlin has perfected a *round breech bolt* for big game rifles long famous for solid top receiver, safe side ejection; accuracy and dependability. (1) New breech bolt is *completely encircled* in the region of the locking mechanism, locks more securely than ever. (2) New receiver allows more precise fit of bolt. (3) Round bolt locks into round receiver hole, giving more steel, more strength and rigidity. (4) Greater precision in jam-proof cartridge feeding. (5) New and more durable extractor. *Marlin 336's are the only lever action high power repeaters allowing full low central telescope mounting.*

MARLIN 336's High Power Repeaters 30/30 and .32 cal.

**Prices slightly higher west of the Rockies*

THE MARLIN FIREARMS CO., NEW HAVEN, CONN.

MODEL 336 CARBINE, with full magazine of 7 shots and 20" barrel, is ideal for fast shooting in brush and from horseback. $61.45*

MODEL 336 SPORTING CARBINE—6 shots, 20" barrel—has the balance and feel of a longer rifle, yet handles fast in thick cover. $61.45*

MODEL 336A-DL RIFLE—6 shots, 24" barrel, for open country. $87.50*. 336A Rifle—same as DL model, without checkering and strap. $72.55*

Who said good blades have to be high priced?

NEW catalog plus sample package 4 double edge Marlin Blades — yours for 10¢ to cover postage and handling. Mail coupon.

The Marlin Firearms Co., Dept. 76 New Haven, Conn.

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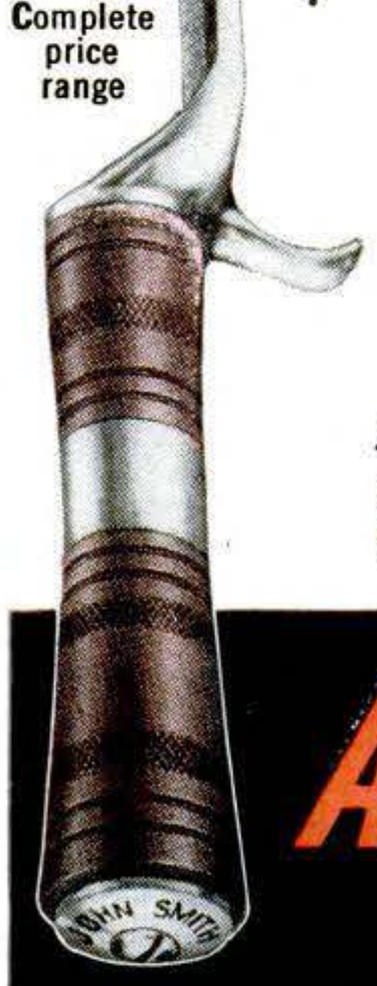
Once you've tried Actionrod's *live* action, you won't forget it!

Actionrod is solid steel—delicately balanced, responsive to the touch. Its "custom-built" feel—the result of years of experience in tapering and tempering—is as comfortable as your old fishing hat.

For easy, effortless casts . . . for greater accuracy every time . . . you need an Actionrod. Your favorite sports store has it.

ORCHARD INDUSTRIES, Inc. • Detroit 5, Mich.



Complete price range

Wedge-Type Reel Lock

Owner's Name on Handle

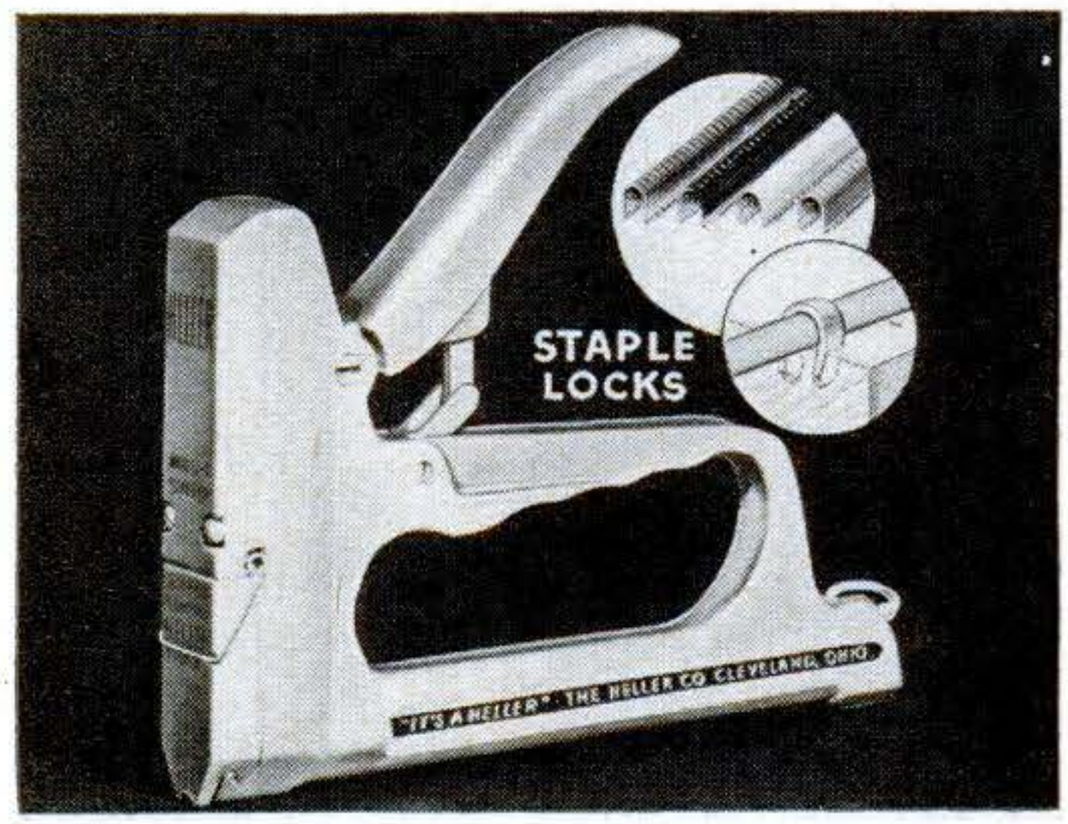
ACTIONGLAS **Orchard's great new development in glass rods. Available in casting and fly rods. $25 to $35.**

Actionrod

"SOLID STEEL WITH LIVE ACTION"

Box Magnifies Sound

THIS 8½-oz. electronic sound magnifier does for people whose hearing is slightly impaired what eyeglasses do for those who are nearsighted. Called the Hearette®, it is designed to be carried in a pocket or handbag and held to the ear under conditions where the sound level is below that of ordinary conversation. At full blast, though, it's said to increase the power of sound to the ear more than 100,000 times.



Stapling Gun Speeds Wiring

A NEW pistol-grip staple driver, shown above, makes quick work of clipping electrical wiring to baseboards, walls, door jambs, window frames, or rafters. Made by the Heller Co., of Cleveland, the gun has been adopted by the Bell Telephone Systems for installing low-tension lines. Insets show its ammunition—staples in different colors to match the wiring—and how it pushes them into wood or plaster.

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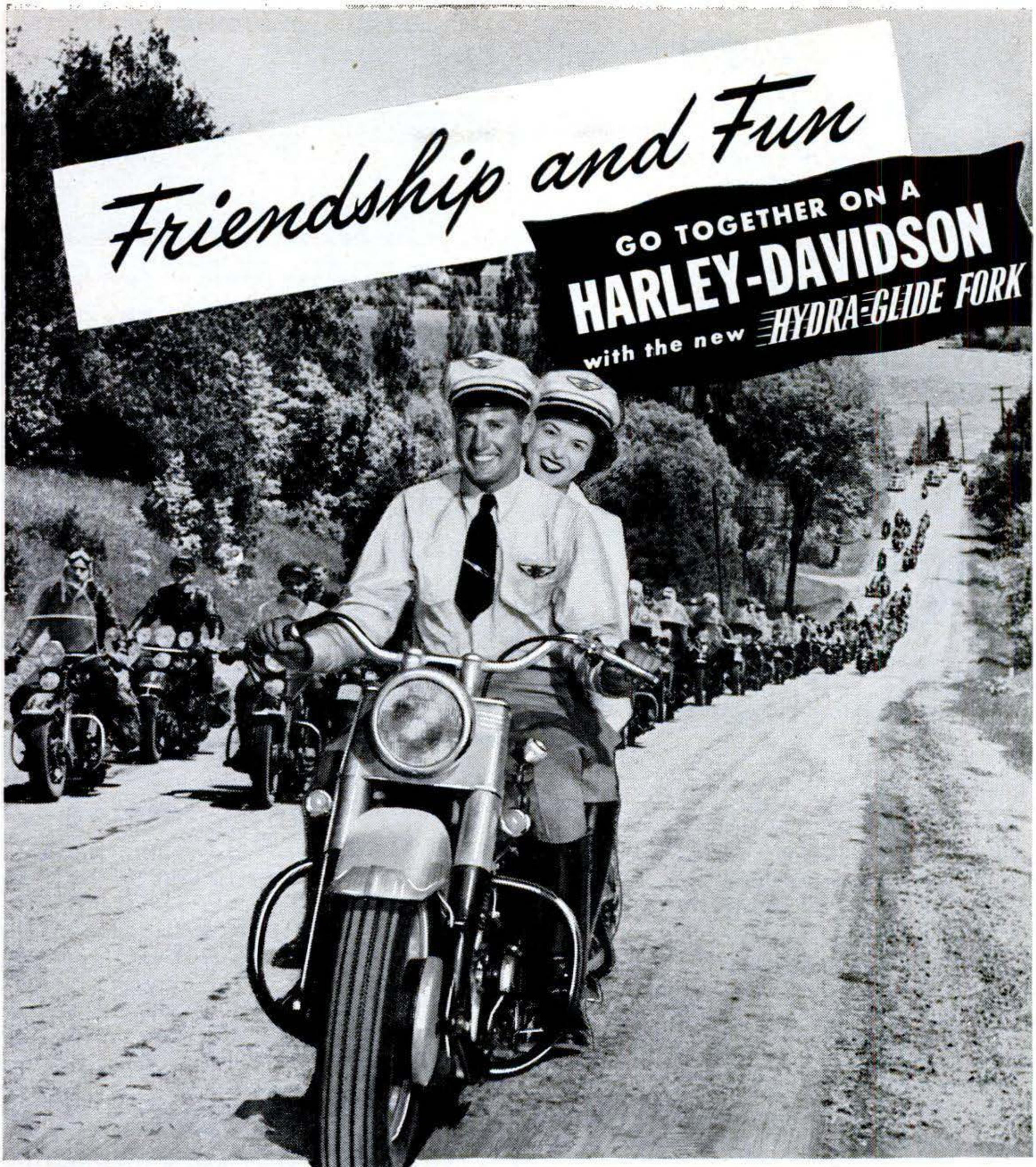

"It's always fair weather when good friends get together"... on their Harley-Davidsons! And you're always headin' for fun ... when you hit the thrill-trail to exciting race meets, hillclimbs and endurance runs, to delightful sightseeing trips and gypsy tours. No sport in the world is like motorcycling, no pleasure like riding a super-smooth, powerful Harley-Davidson ... champion of motorcycles! Owning your own is easier than you think. See your dealer today. Mail the coupon now.

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ACID-CORE SOLDER

Insist Upon
Kester Flux-Core Solders

Kester Metal Mender, the handy "tool kit" size package of acid-core solder, is the home repairman and hobbycraft worker's standard for all metal jobs.

Kester Radio Solder, plastic rosin-core, is also available in the handy coil size. The finest solder made for all electrical and radio work.

Standard for Home Use
Since 1899

Kester Solders are also available in 1- and 5 lb. units.

1899 50th Anniversary 1949

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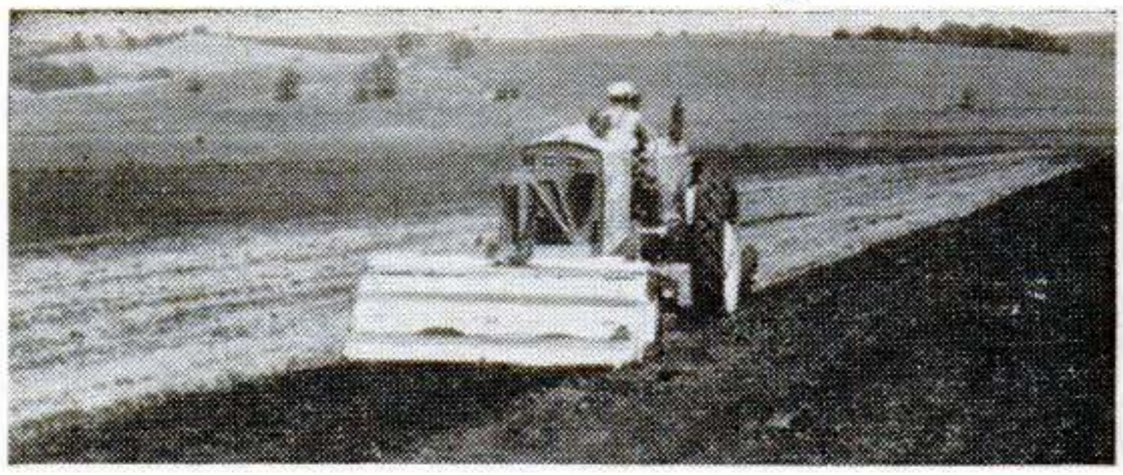
KESTER SOLDER

BETTER CONTROL* *of Growing Conditions*



* Available Plant Food • Soil Moisture • Soil Aeration • Insect and Pest Control • Soil Temperature

with a SEAMAN ROTARY TILLER!

A SEAMAN ROTARY TILLER means *better* and *lower cost seedbeds . . . better control over vital growing factors.* Many Seaman users report *increased crop yields* (often 35% or more).

HERE IS WHAT HAPPENS: The power-driven Tiller tines break up clods and aerate the pulverized ground . . . which helps warm up the soil, hastening seed germination and promoting earlier maturity. Some users increase aeration by tilling with hood up, also helping to control weeds and insects.

The pulverizing action also creates more capillary paths for water to follow. You lose less water and nutrients through erosion, evaporation, and leaching.

Fertilizer is mixed throughout the topsoil depth for quicker and more effective decomposition.

Power take-off and motorized units (gas or diesel) . . . 3 to 7 ft. tillage widths. Write for Bulletin NST and see your Seaman dealer.

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Build Better Trailers with Safety-Engineered

- ★ Torq-less Axles
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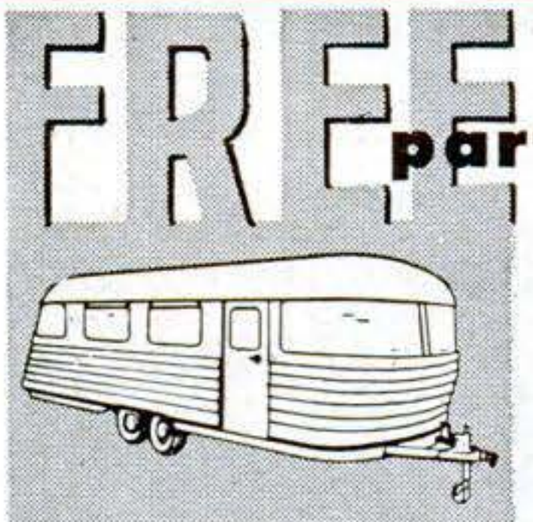

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*Within 35 mv/m from 540 kc. to 150 mc. at 50 ft.
Auto-Lite Spark Plugs — Patented U.S.A.

NEW AUTO-LITE *Resistor* SPARK PLUGS

Acclaimed by car owners coast-to-coast

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Car dealers, service station operators, garage men, Police Departments and taxi companies tell us of their enthusiasm for the smoother idle and improved gasoline economy experienced.

See your Auto-Lite Dealer today for a complete new set of Auto-Lite Resistor Spark Plugs.

Toronto, Ont. **THE ELECTRIC AUTO-LITE COMPANY** Toledo 1, Ohio

BECAUSE OF ITS LOW RATE OF ELECTRODE EROSION, THE NEW AUTO-LITE RESISTOR SPARK PLUG PERMITS WIDER INITIAL GAP SETTINGS AND MAKES THESE ADVANTAGES POSSIBLE.

AUTO-LITE *Resistor* SPARK PLUGS

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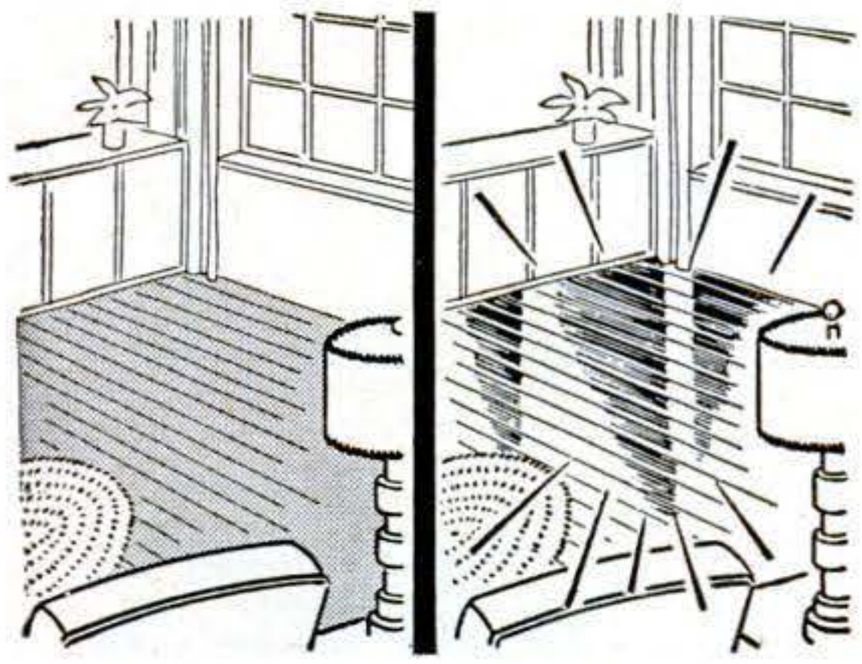

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WHY BREAK YOUR BACK MOWING FIELD OR LAWN?

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SAVE MONEY SAVE TIME

IT'S FUN TO BUILD

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IT WELDS • IT BRAZES • IT SOLDERS

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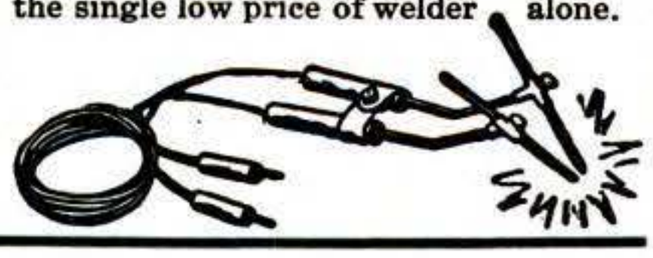
TWIN CARBON TORCH (illustrated) for use with DYNAMIC is unsurpassed for brazing, soldering, pre-heating and cutting iron, steel, brass, bronze and other metals. With it you greatly increase profitable uses of your welder. Does work of oxy-acetylene torch. Comes complete with instructions, carbons and cables. For LIMITED TIME ONLY we are giving a Twin Carbon Electric Arc Torch worth $6.80 with every DYNAMIC WELDER. Act now to get this valuable premium at the single low price of welder alone.



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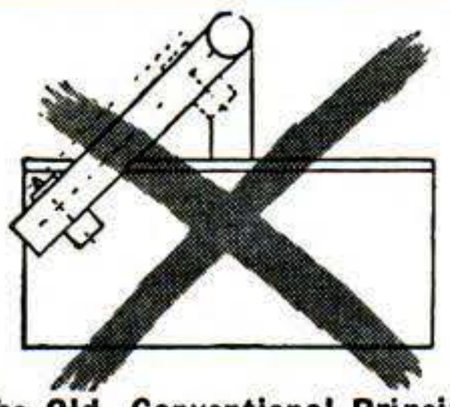
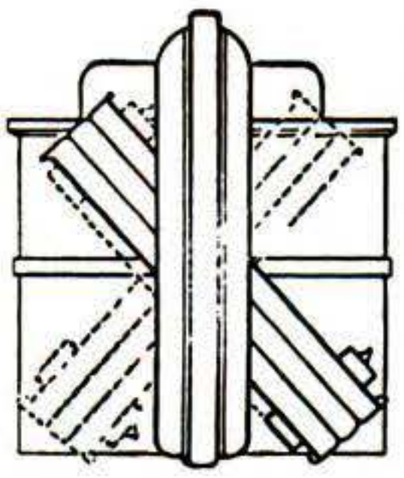
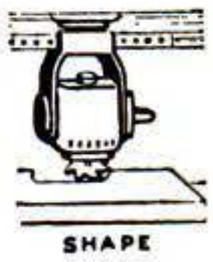


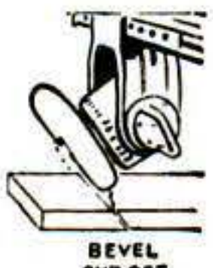
The Old, Conventional Principle— This shows how conventional radial-arm saws pivot from the column. They have practically no mitering capacity at 45°, not much usable capacity at 30°, and almost none beyond 45° on left-hand miters.

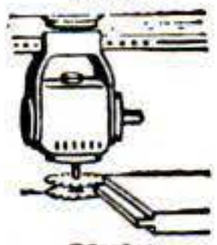
The Modern Delta Multiplex principle — This shows how center-pivoted saw arm permits Delta Multiplex to be set quickly to cut any miter — right- or left-hand—at full capacity up to 90°. The saw rotates through 360°. Permits unlimited number of saw positions, greater capacity and ease of operation.

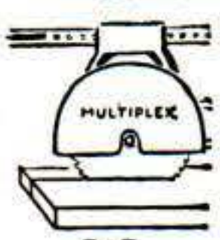


One Multiplex does all this — *and more!*









(Models 40A and 50A only)

✓ **Cutting arm rotates 360° — you get an unlimited number of saw positions!**

✓ **You get 100% mitering capacity — you can cut full-length miters, both right-hand and left-hand — from 0° to 90°!**

Your nearby Delta distributor has a complete line of Multiplex models with motors ranging from ½ H. P. to 10 H. P. and rip capacities from 2" to 6". Inspect them there. See for yourself the Delta Multiplex features that assure you of safety, speed, convenience, capacity, and economy. And ask about buying on easy credit terms. Look for the name of your Delta distributor under "Tools" in the classified section of your telephone directory.

Send coupon for free bulletins!

Model 20A—Bench model. An exceptionally low-cost portable machine. Can be carried easily in the back of your car. Has a rip capacity up to 2". A favorite of builders, for cutting interior trim. With ½ H.P. Single Phase 110 Volt Motor---------- **$195.00*** F.O.B. Norwalk, Ohio

Model 40A—Floor model with cabinet base. Two men can carry it. Has a rip capacity up to 3¼". Widely used for cutting foundation forms, sheathing, roofing, cabinets, doors, frames, drawers, sills, stair treads, etc. With 1½ H.P. Single Phase or 3 Phase Motor---------- **$385.00*** F.O.B. Norwalk, Ohio

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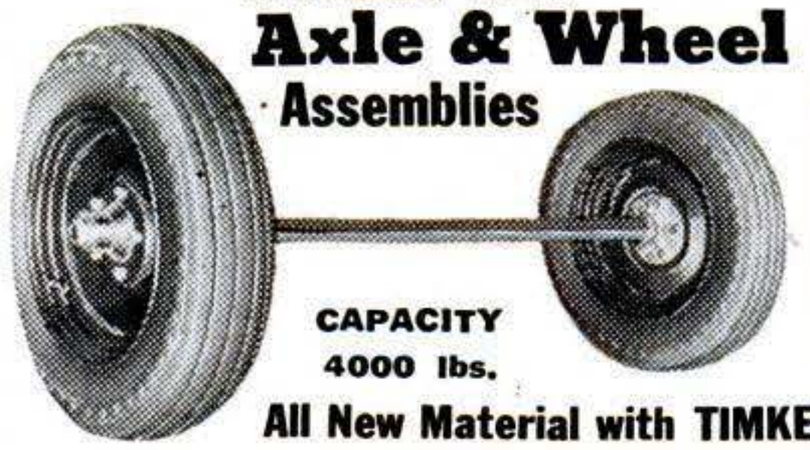

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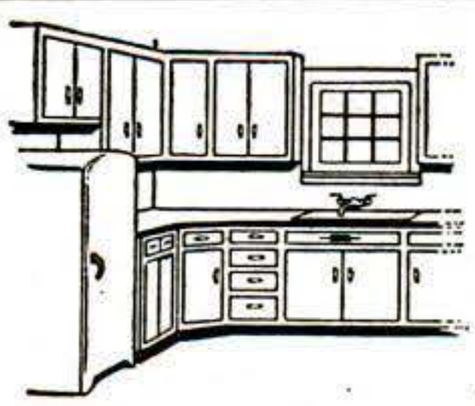

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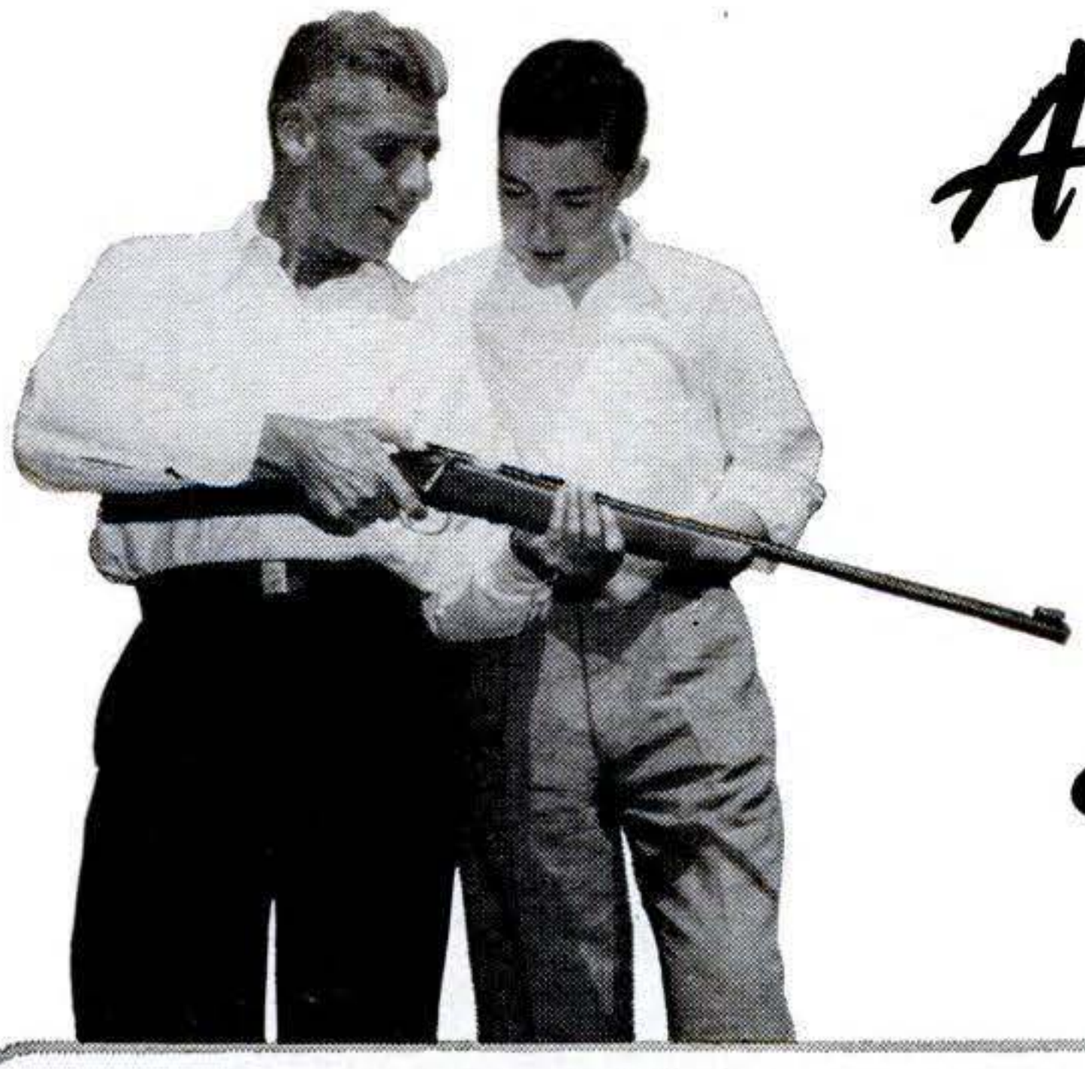

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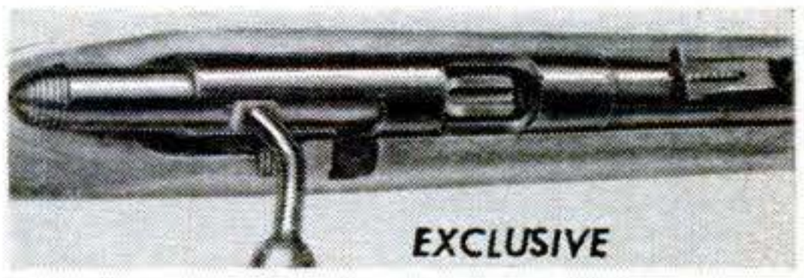

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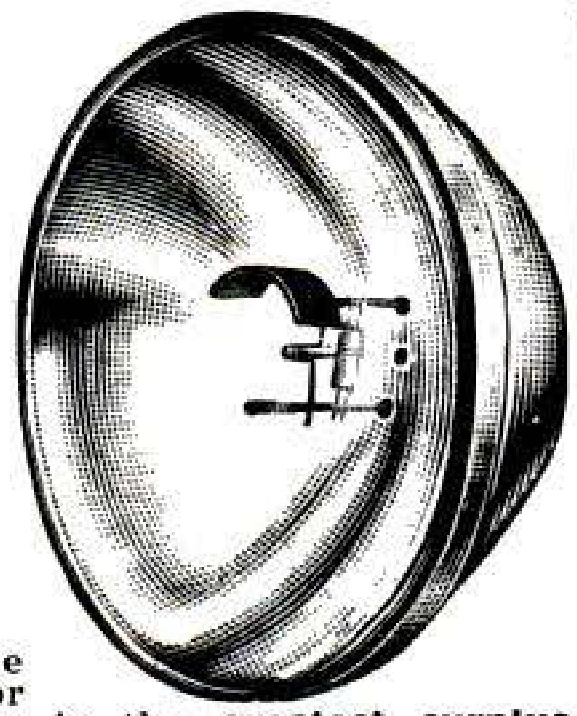

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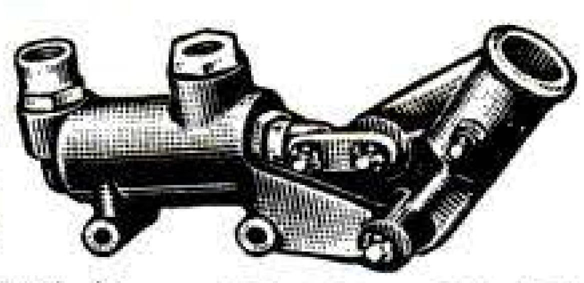

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Used for hydraulic jacks, presses, hoists and other hydraulic applications. For operating hydraulic cylinders to pump oil or hydraulic fluid under pressure.
Hand pump has built-in check valve and is capable of delivering 1000 lbs. of pressure. Has alloy aluminum housing. Dimen.: 8" long x 3½" high x 2¾" wide. Ship. wt. 3 lbs. A $45.00 value................Now **$8.95 postpaid**

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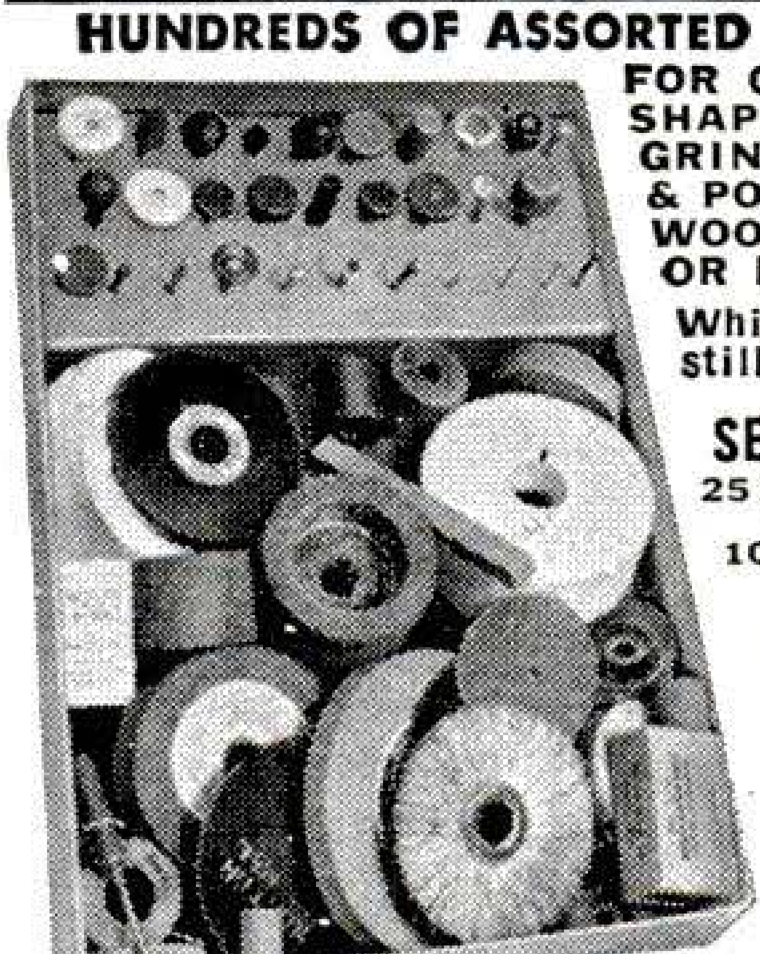

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- 2 Felt bobs
- 10 Sanding rolls
- 6 Sanding sleeves
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In sturdy compact container 13¼ x 9¼ x 2½", weight 8½ pounds; with installed rack for all drills.

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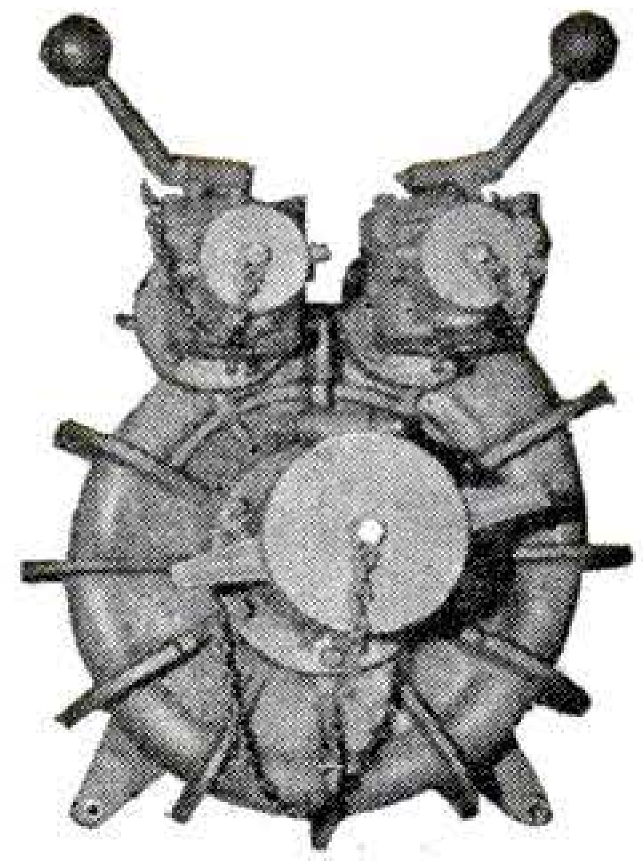

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Equipped with 1½" diameter straight splined shaft for direct coupling drive; 4½" threaded suction intake; two—2½" threaded discharge outlets; Hale Pump Co. Model CF volute type. Use any 4 or 6 cylinder gas engine or couple directly to front of truck or auto; or use 25 H.P. electric motor. Dimensions: 21" x 24" x 28". Complete with full accessory kit including suction and pressure gauges, priming equipment, and instruction book. Shipping wt. 415 lbs............
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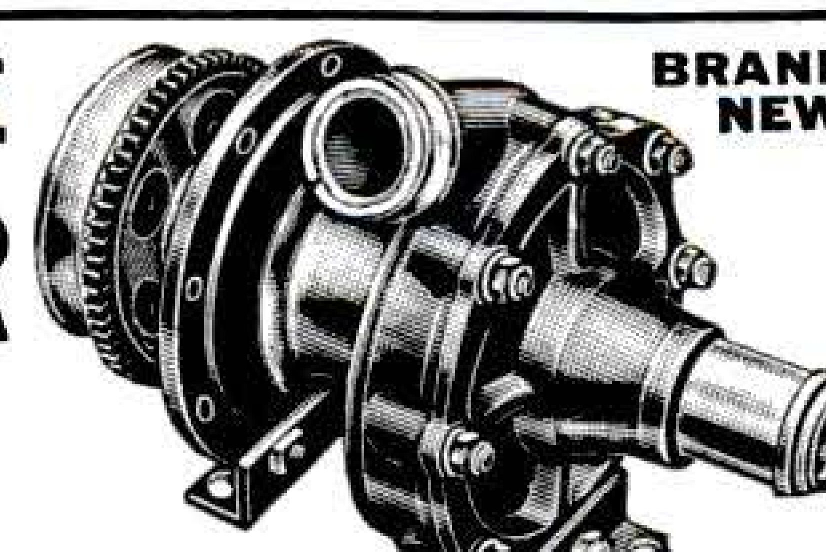

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Use it for:
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Complete with pulley and mounting brackets, ready for use.

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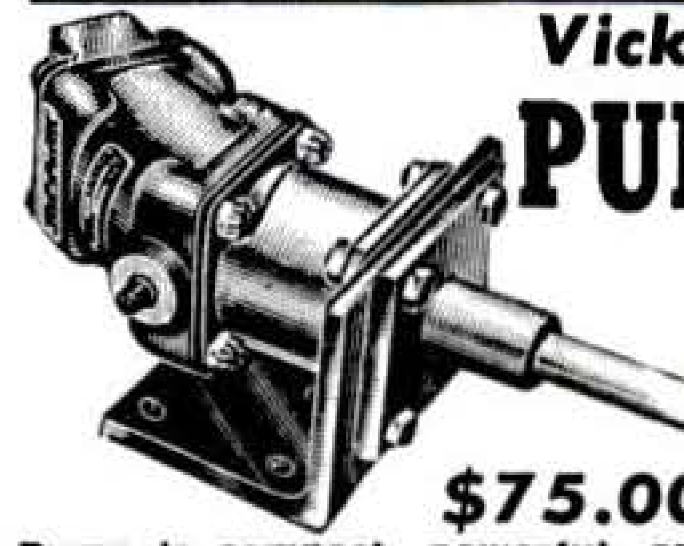

complete with mounting kit ready to install

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Mounting kit has been especially designed to provide maximum utility and ease of mounting MF Series Vickers Pumps. Brackets are constructed of heavy steel plate; shaft is made of ½" steel with one end splined to fit pump; other end of shaft has machined flat for mounting a standard pulley with ½" hole. Shaft runs in oilite bronze bearings.

Pump only ....$14.95 postpaid
Mounting kit only............................$ 4.95 postpaid
Both as complete unit....................$19.90 postpaid

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PRESSURE GAUGE

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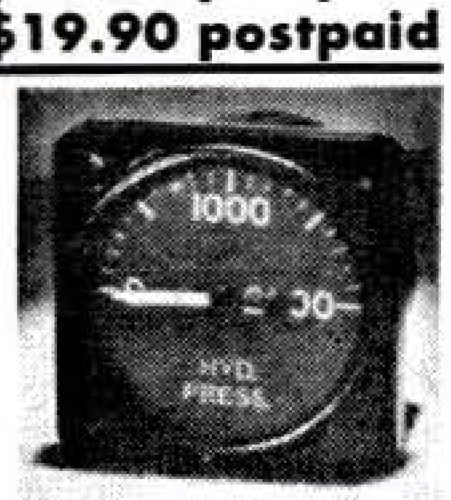

Ideal for high pressure hydraulic systems, adjusting pressure, relief valves, etc. Range 0 to 2000 P.S.I. Black plastic case 2⅜" square, 1¾" deep. Black instrument face with white pointer and numerals. Worth many times this low price of

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ADJUSTABLE RELIEF VALVE........$2.95 postpaid

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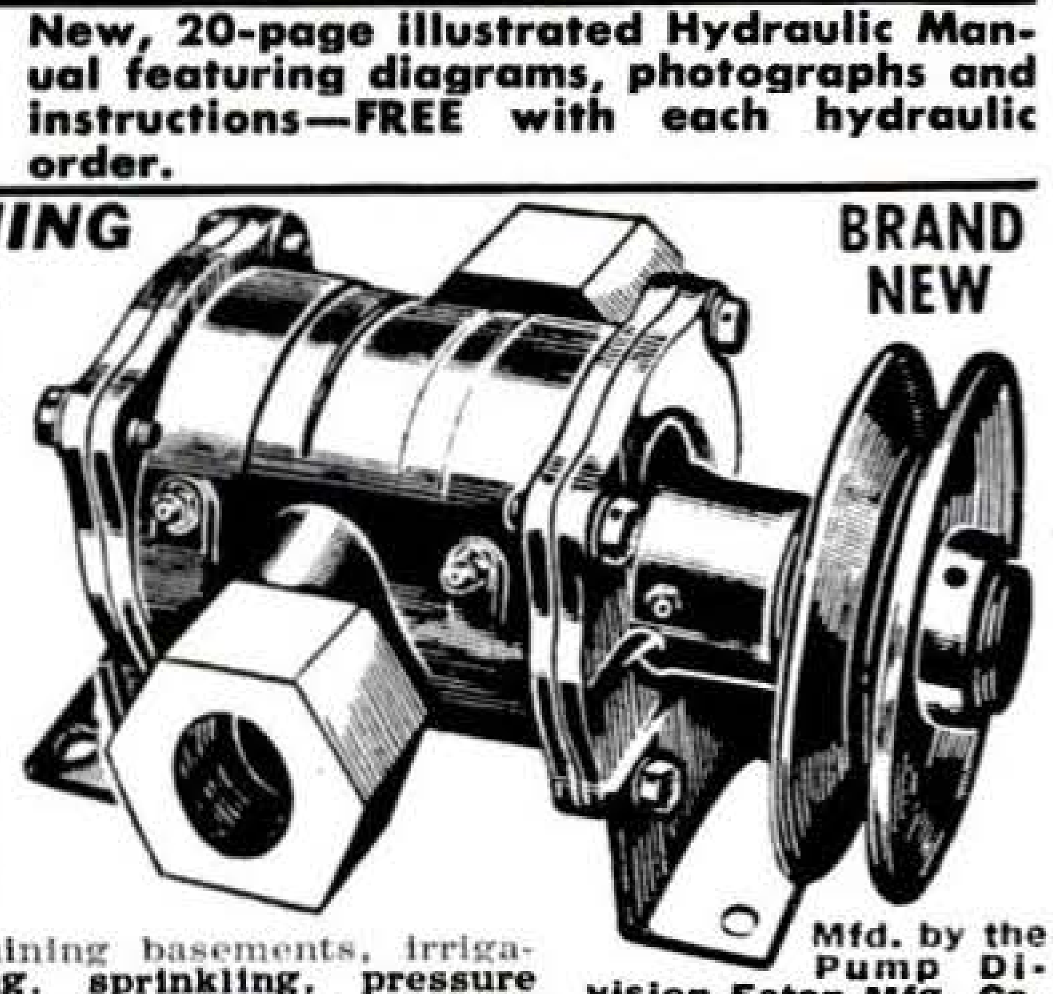
Positive Pumping Pressure



Mfd. by the Pump Division Eaton Mfg. Co.

Perfect for draining basements, irrigation, fire fighting, sprinkling, pressure booster, insecticide and other spraying, fuel transfer, stock watering, industrial pumping, deep well jet pumping and home water systems. Rated 25 ft. suction and 150 ft. head pressure at 80 gallons. Use from ⅓ to 5 H.P. motor.

COMPLETE ENGINEERING REPORT AND INSTRUCTIONS FREE WITH PUMP

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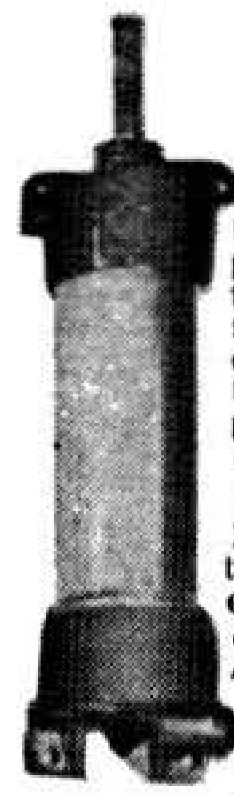

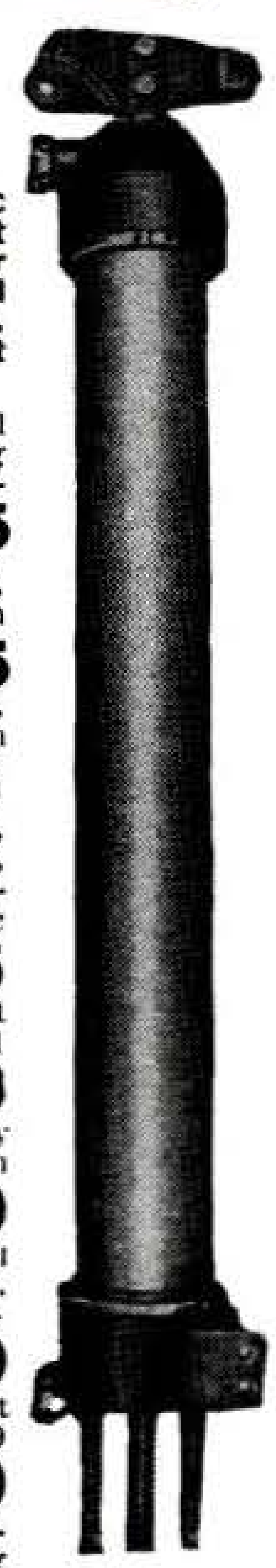

Use hydraulics on arbor presses, hydraulic presses, hay lifts, manure loaders, lift trucks—push or pull, tilt or turn, press or squeeze, open or close, lift or lower—and other hydraulic and industrial applications. Use with either air or oil . . . of finest precision workmanship.

1. Double action, 1" bore, 3" stroke, will lift 770 lbs. in 1/10 of a second using MF Pump. All steel barrel. Ideal for controls, door openers, positioning, etc. An $18.00 value..**postpaid $4.95**

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4. Use these cylinders on farm trucks, bulldozers, hay lifts, manure loaders, etc. Double action, **1½" bore, 27" stroke.** (Will lift 1760 lbs. in 2 seconds with Vickers Pump.) Wt. 8 lbs. A $55 hydraulic cylinder value for only ....**postpaid $12.95**

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Fittings available for above cylinders

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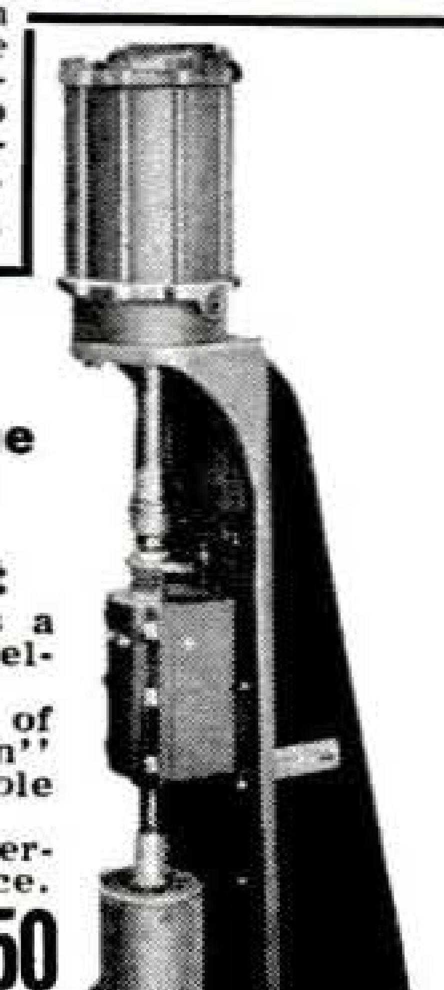

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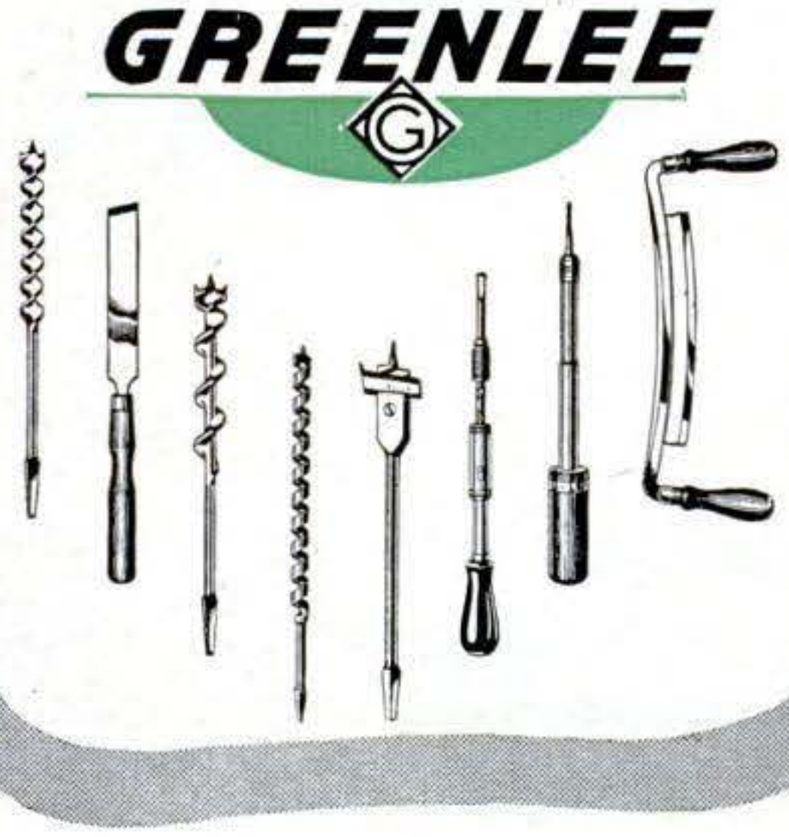

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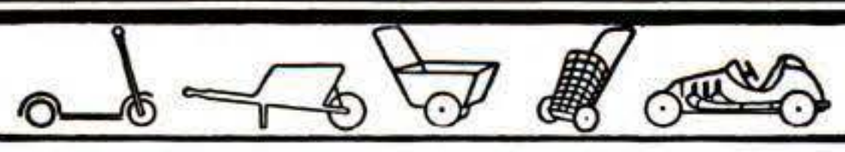

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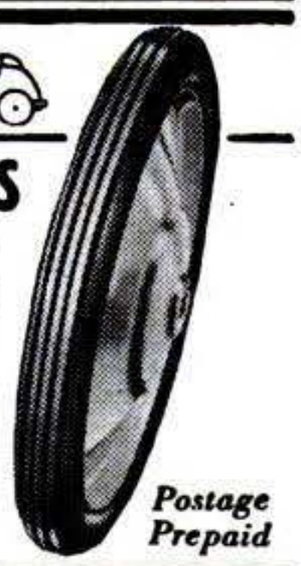

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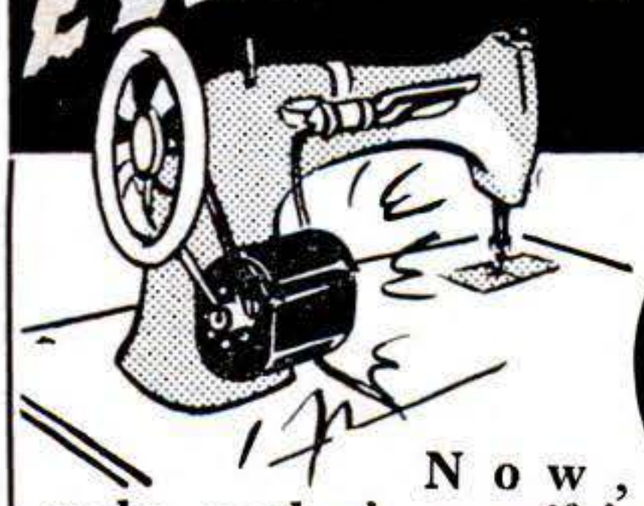

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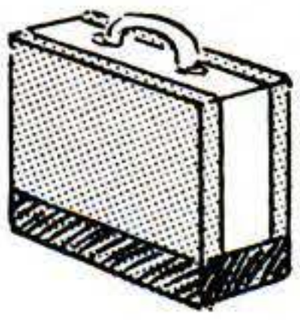

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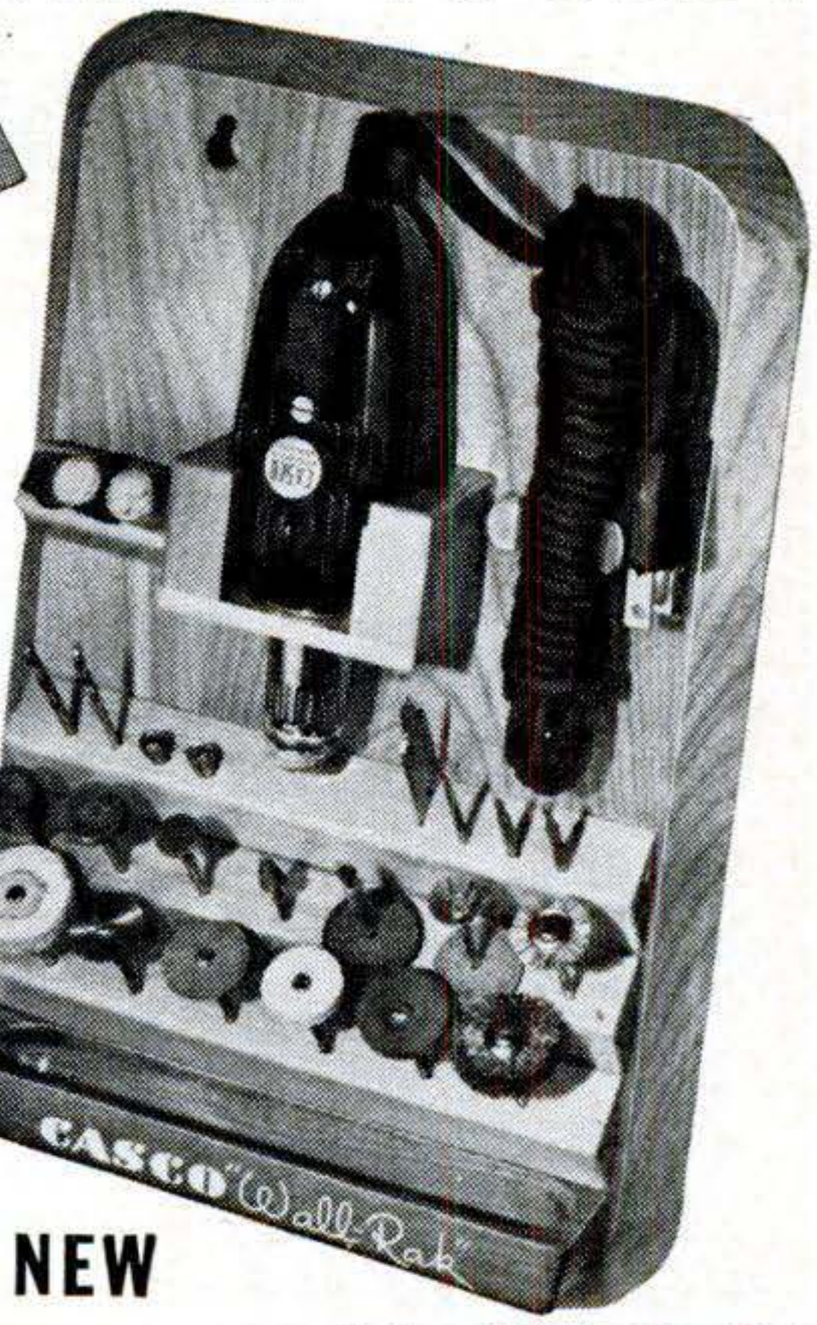

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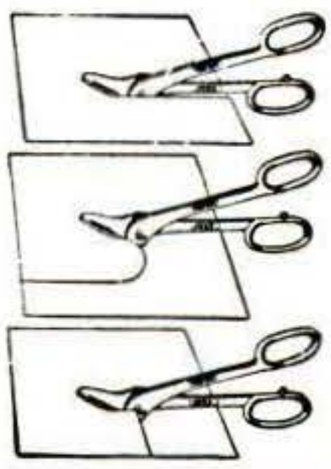

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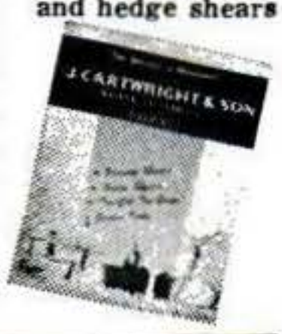

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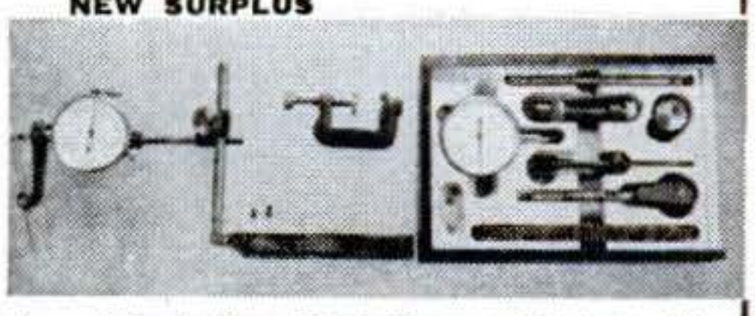

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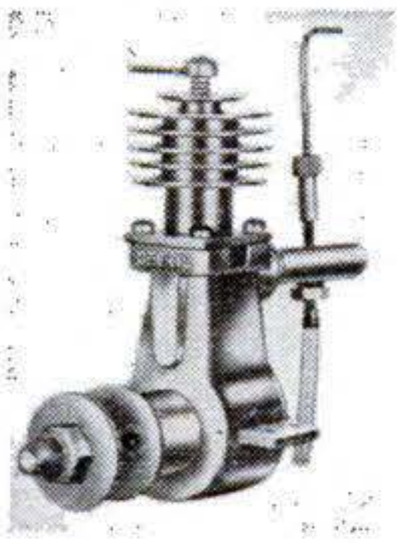

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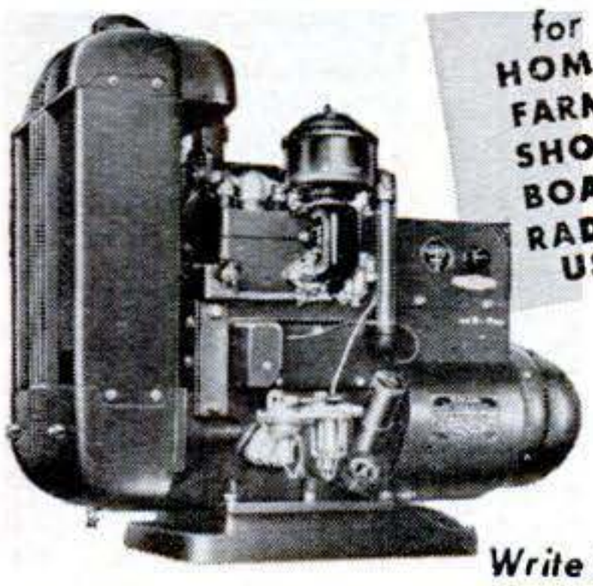

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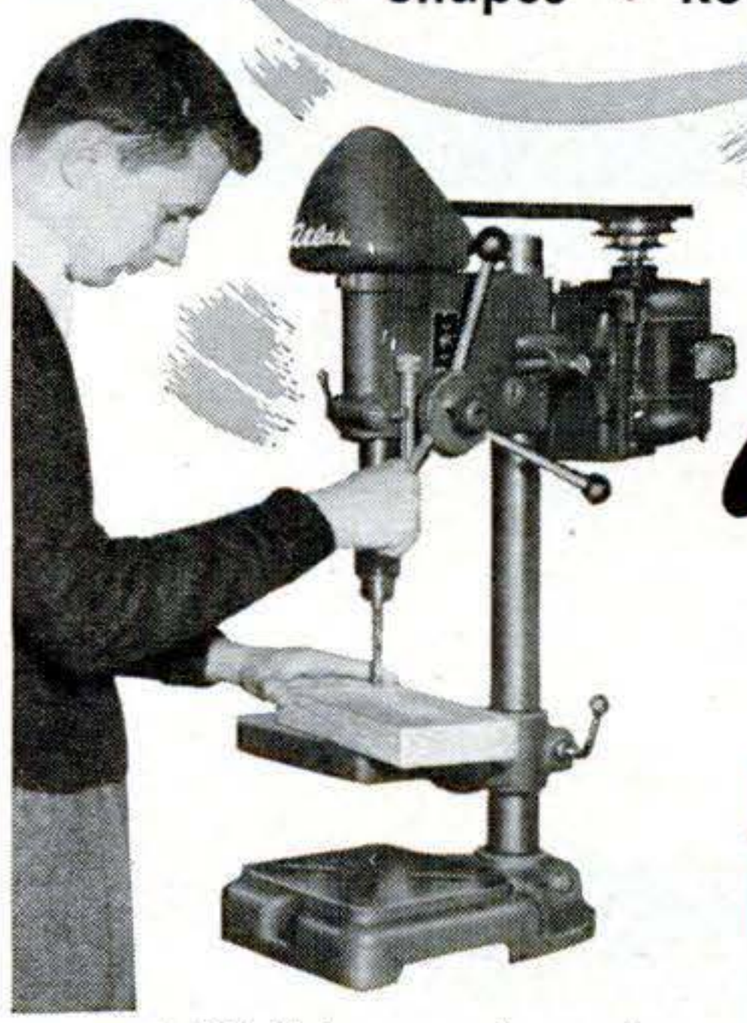

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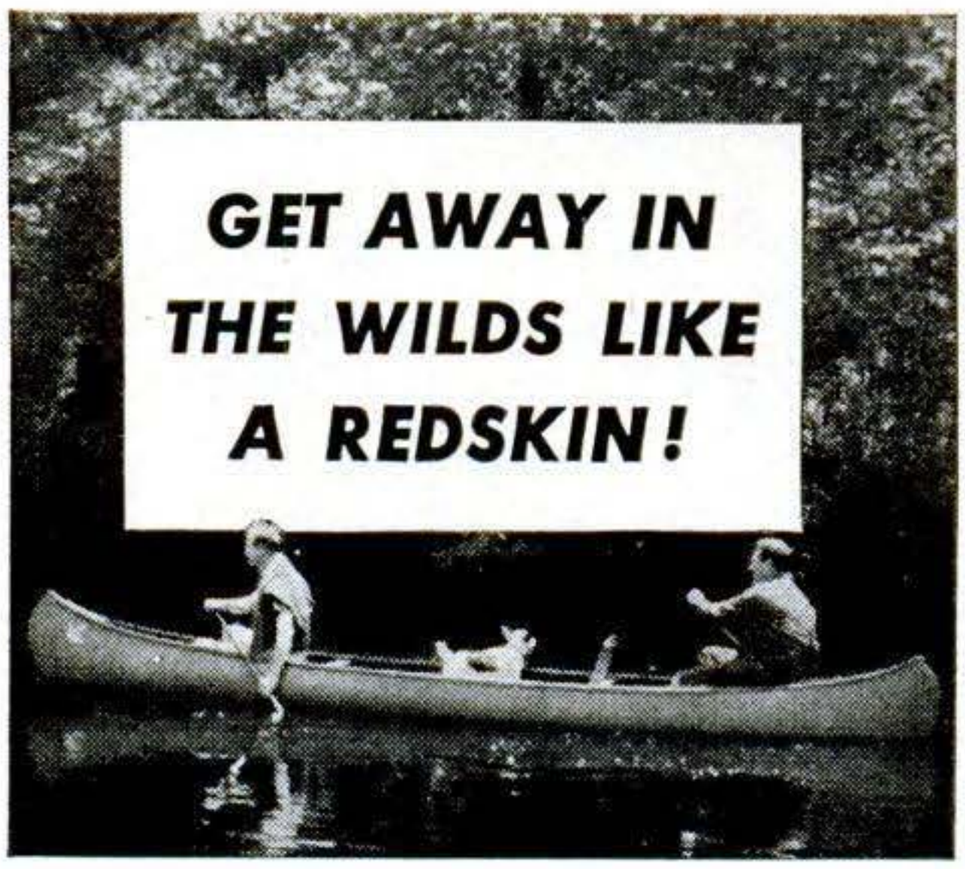

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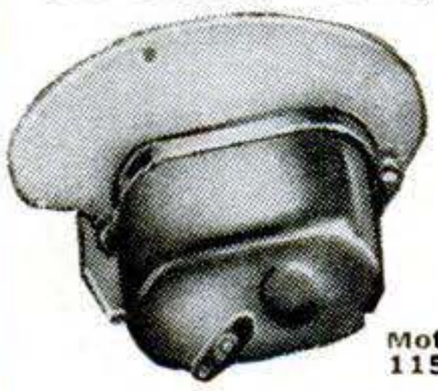

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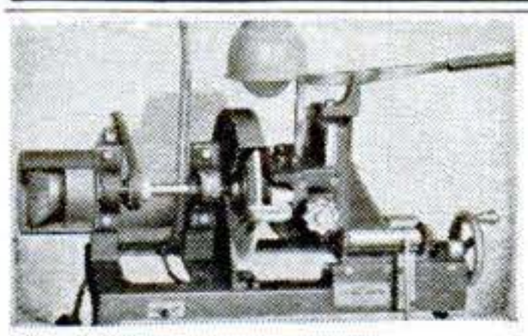

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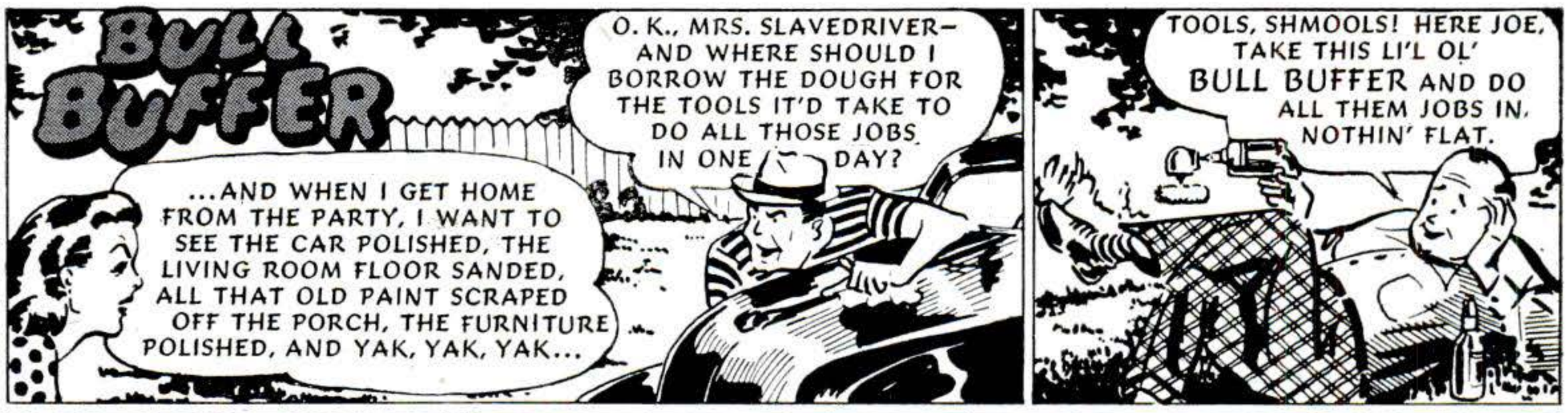

*Bull Buffer comes complete with sheepskin bonnet and 2 sanding discs. **only $9.95.** Bull Buffer alone cuts drill speed ½; for direct drive (or "same as") drill speed, order Adapter A with Bull Buffer **($1.00 extra)**; for twice speed, order Adapter B **($2.00 extra).**

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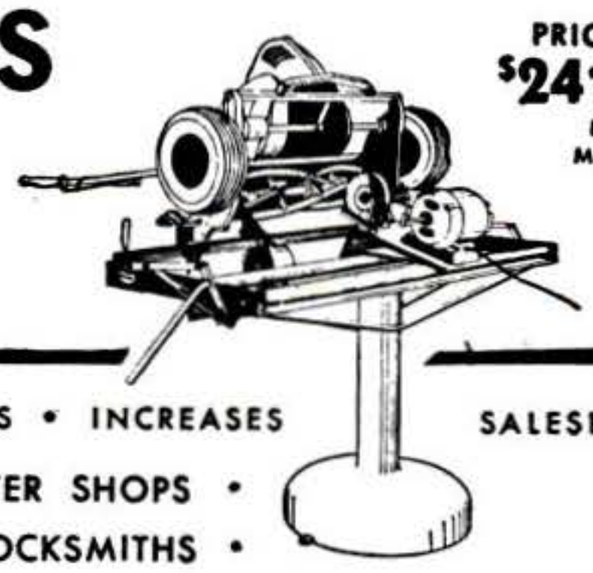

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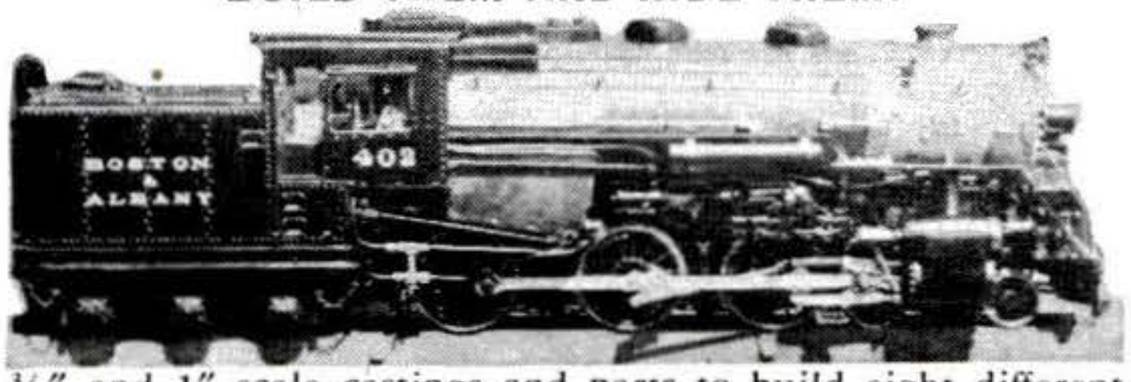

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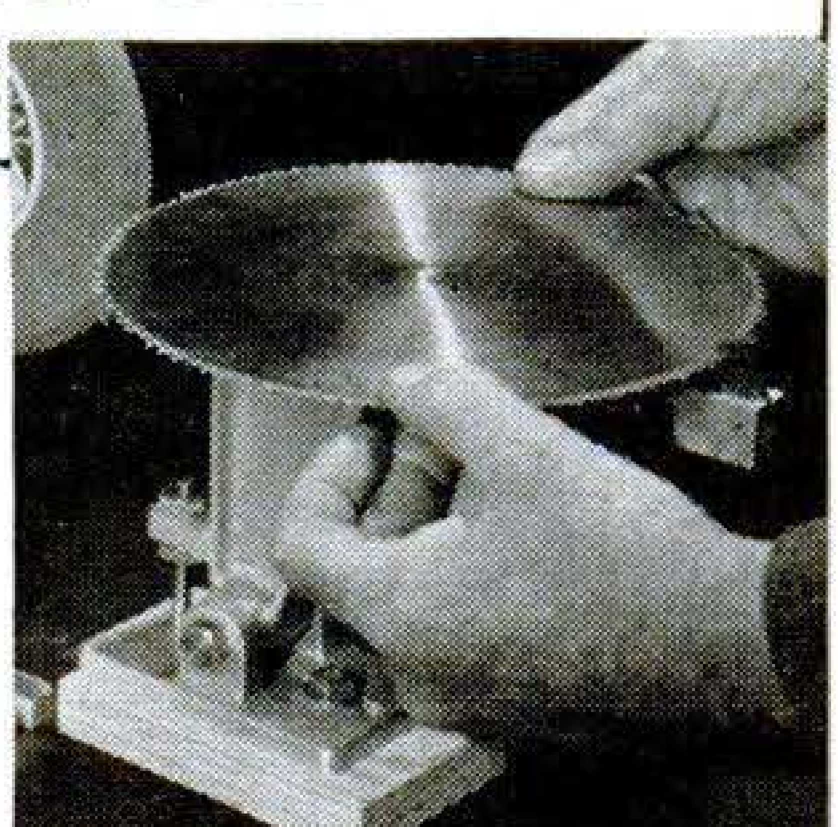

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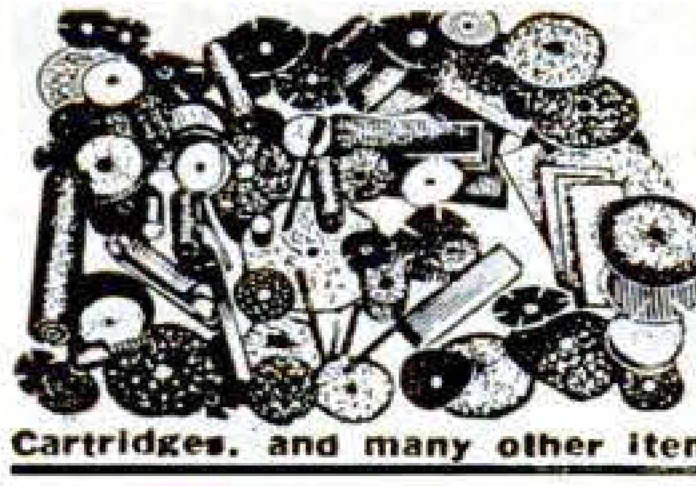

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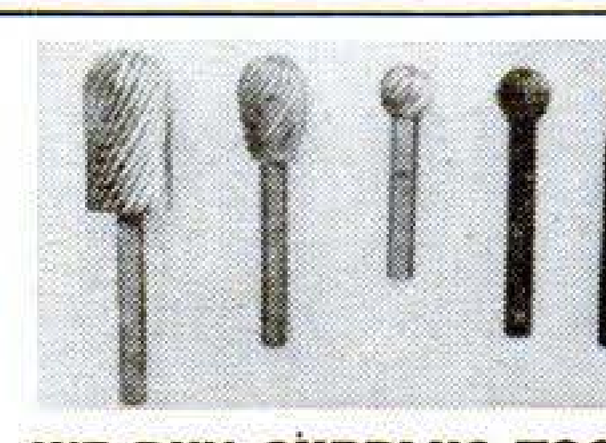

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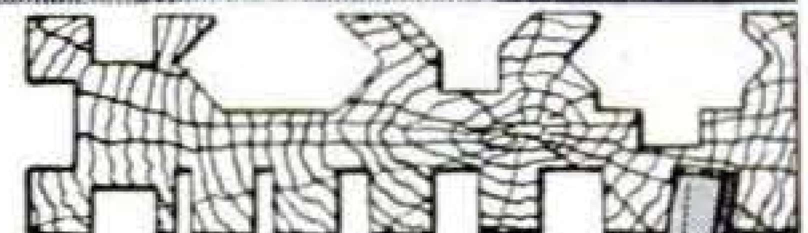

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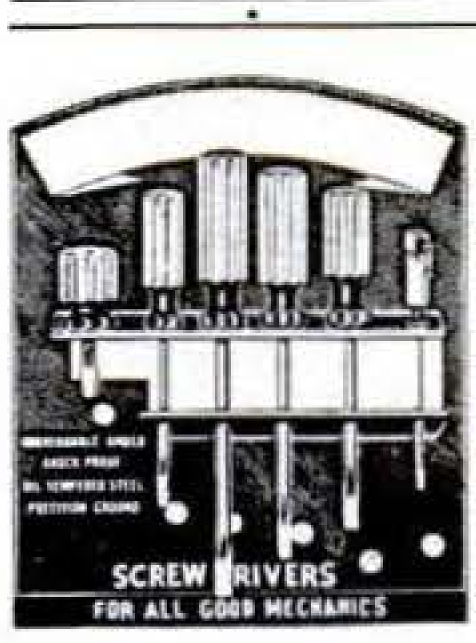

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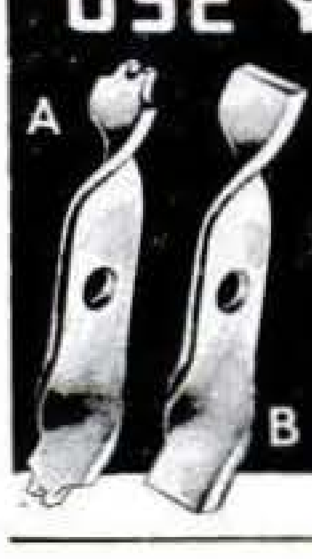

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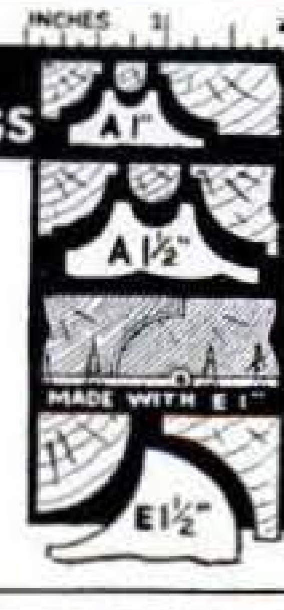

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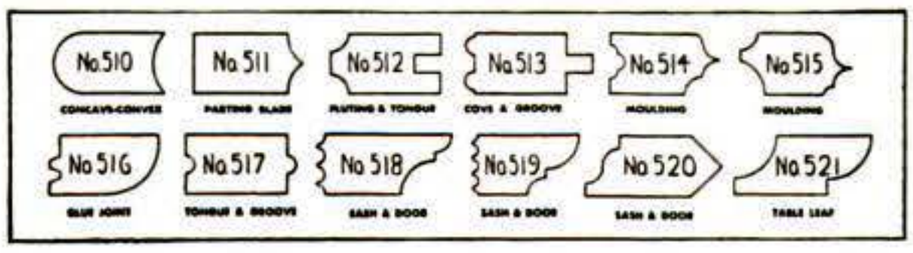

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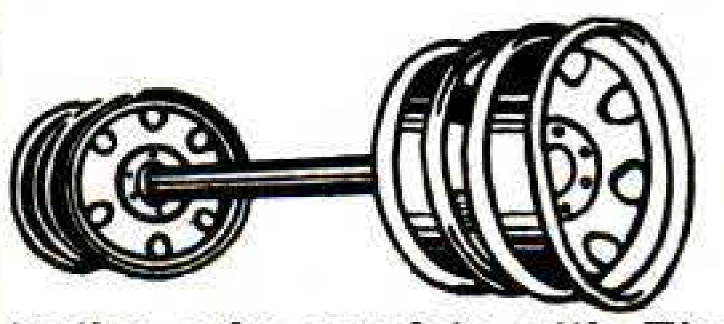

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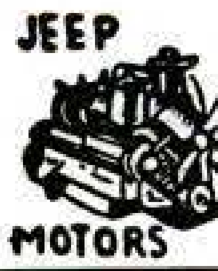

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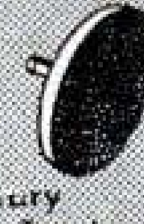

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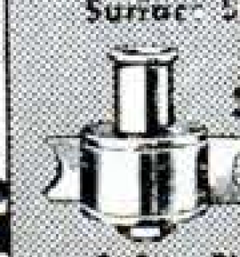

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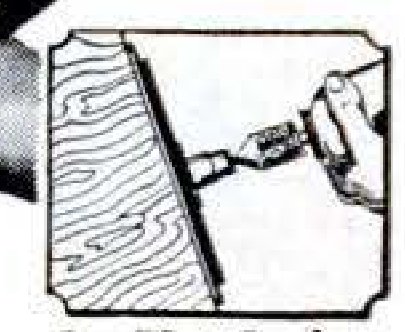
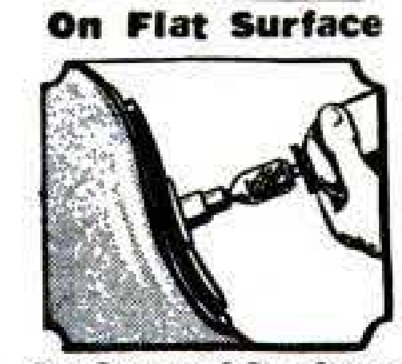


On Flat Surface



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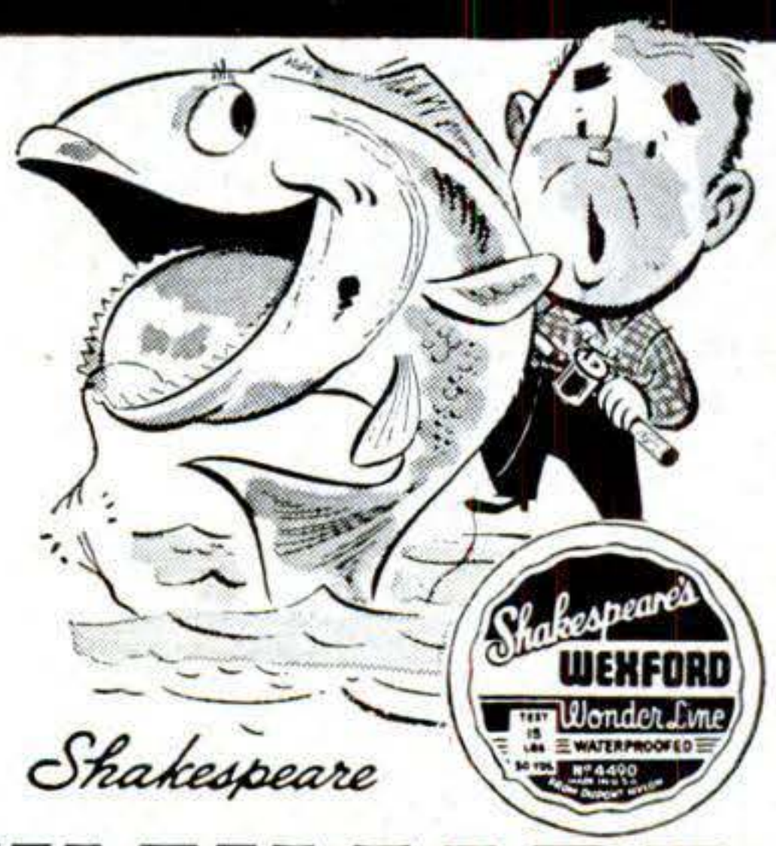

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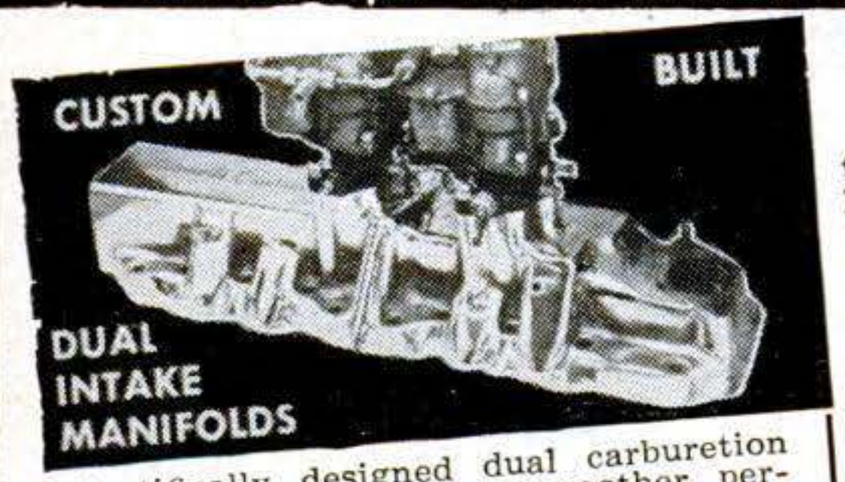

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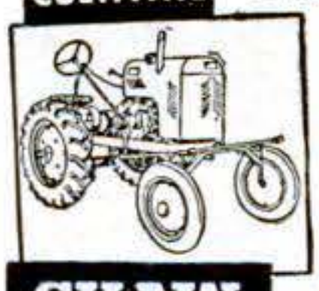

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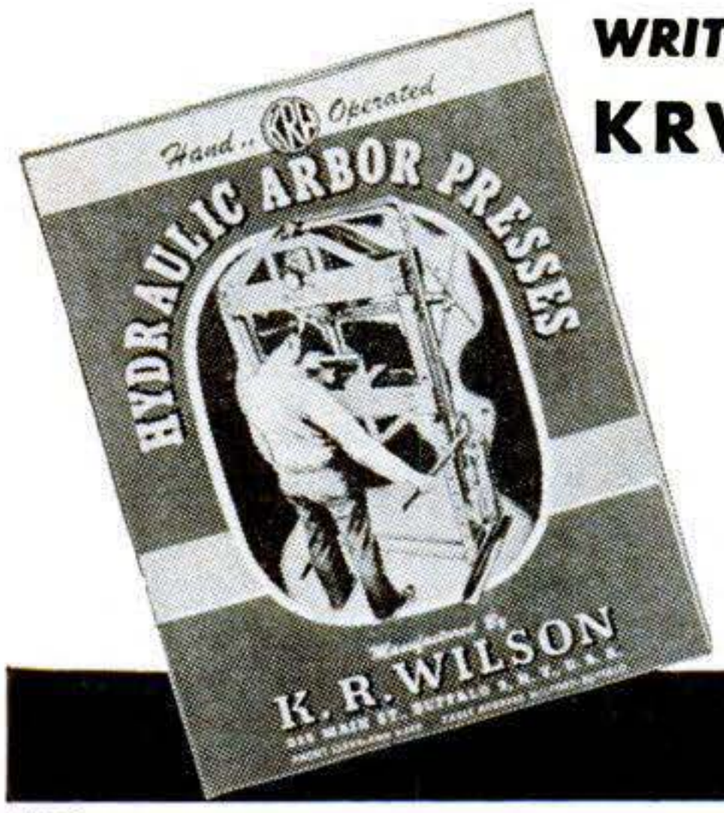

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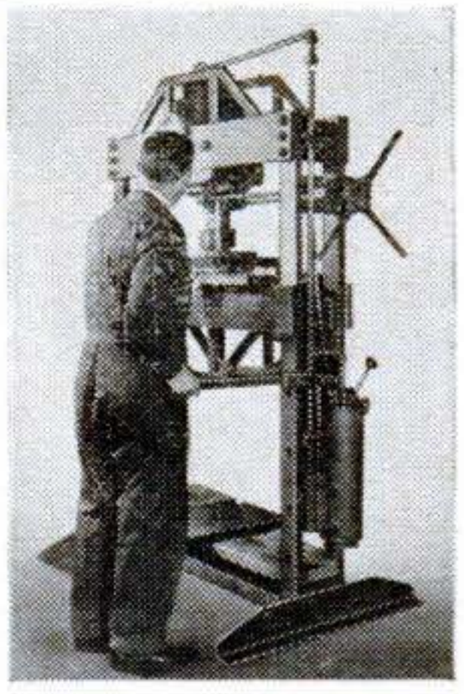

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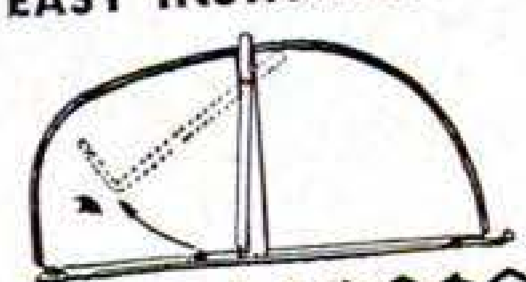

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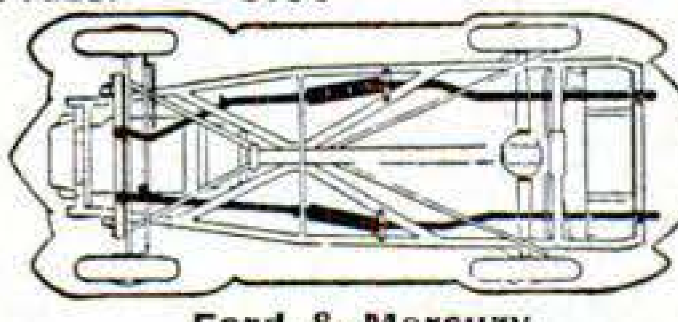

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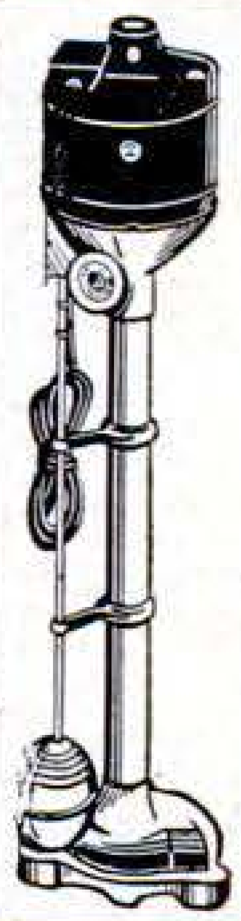

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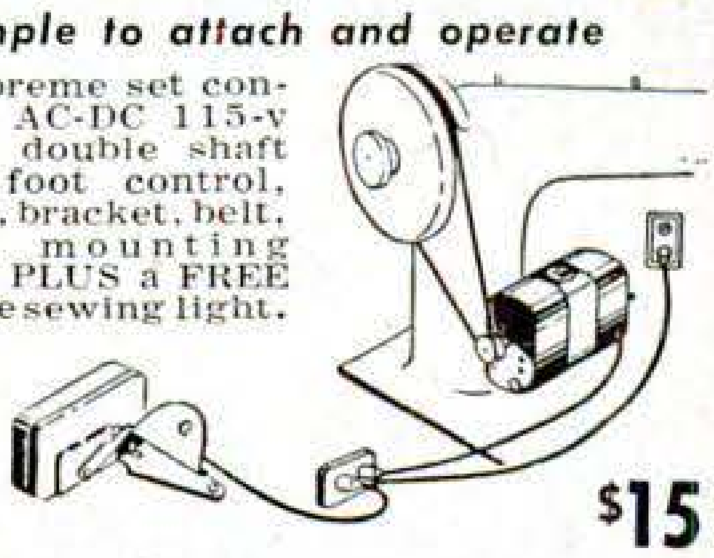

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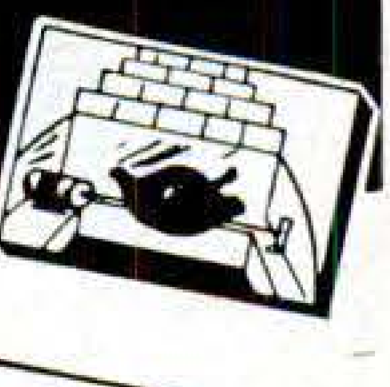

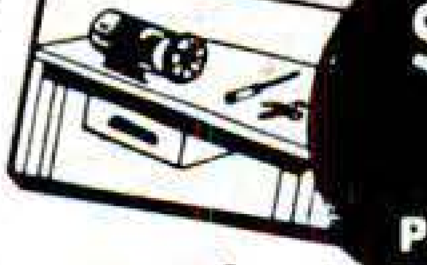

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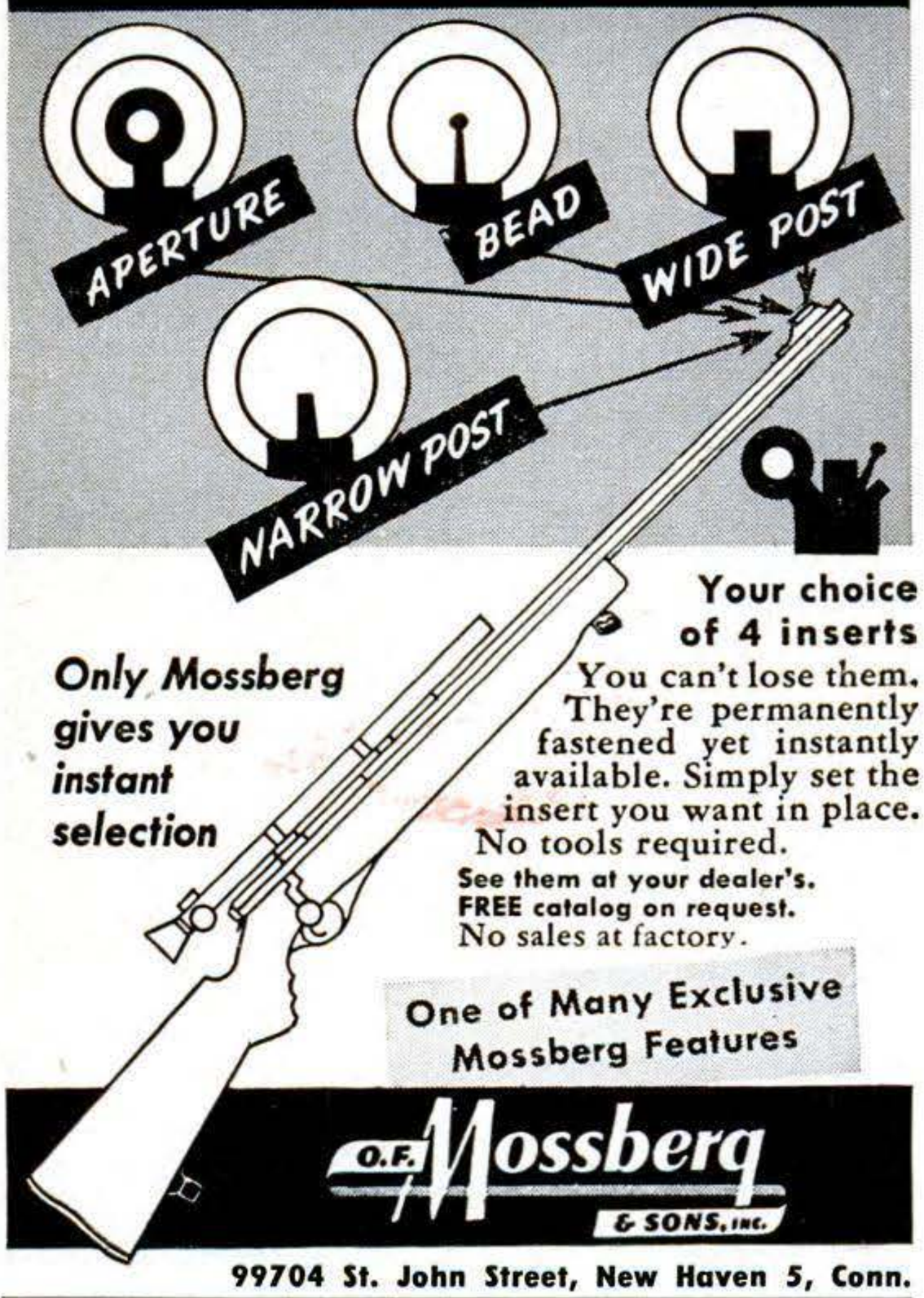

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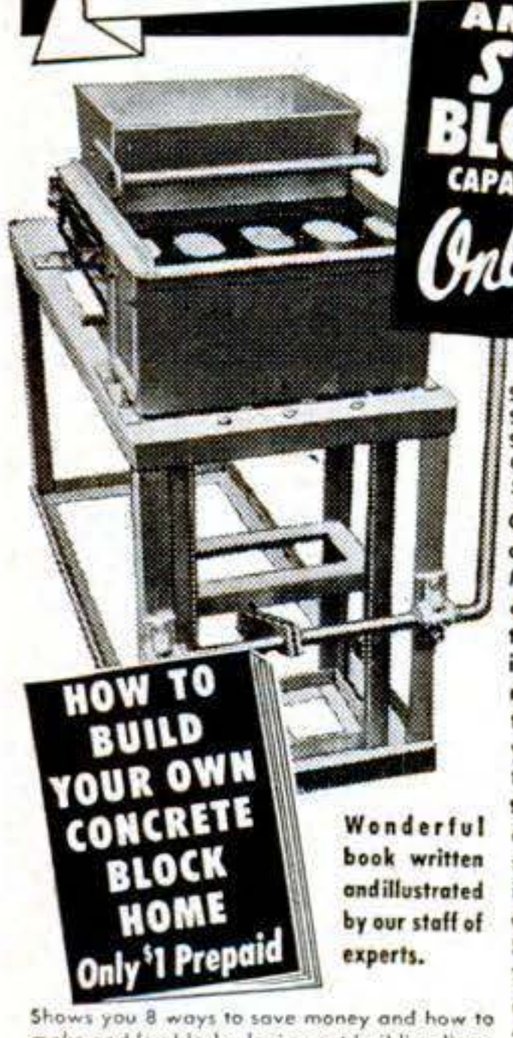

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CAPACITY 1000 BLOCKS PER DAY

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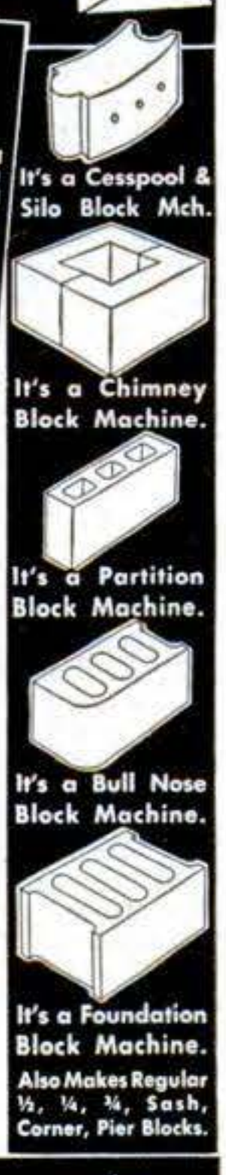

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Sizes for 8" to 16" metal lathes

Build it yourself from our sets of semi-machined castings and save $$. **Can be finished on your lathe alone.** Complete drawings and instructions furnished with castings. Mill keyways, slots, splines, dovetails, flutes in reamers, special cutters. Produce gears, ratchets, racks; bore, face, etc., with this precision attachment.

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The "Pocket-Size Machine Shop"

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With Emery Point
$16.50

HIGH-SPEED STEEL CUTTERS —AT NO EXTRA COST

No modern home workshop is completely equipped without MOTO-TOOL . . . the **correctly balanced** motor-in-hand tool. It grinds, drills, routs, carves, polishes . . . **without vibration.** Higher speed does work better, faster, on practically any material. MOTO-TOOL Kit No. 2 includes **high-speed-steel cutters** for longer life, better work. MOTO-TOOL is backed by over 12 years of industrial use . . . packs years of pleasure. Due to wide popularity and increased production, **Dremel's pre-war prices still prevail!**

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With 23 Accessories
(High-Speed Steel Cutters, Grinding Wheels, Polishing Accessories)
$23.50

NEW DRILL PRESS—only $9.95
This 12" high precision drill press is ideal for model making, wood carving, routing, etc. Utilizes No. 2 Moto-Tool. (Less Moto-Tool)

Look for These Moto-Tool Features

Approximately 27,000 R.P.M. plus dynamically balanced armature provides vibrationless finger-tip control. Moto-Tool has oilless, sealed bearings • Patented automatic chuck lock pin • Over-size armature shaft—hardened, ground, polished • 110 Volt, AC-DC motor • Sliding snap-type switch • Cord protector • Shockproof bakelite housing • Dust-filtered aircooling system • Weighs only 13 oz.

MONEY-BACK GUARANTEE: Buy Dremel Moto-Tools from your dealer. If he cannot supply you, order direct on 5-day trial, money-back guarantee. Shipped postpaid for payment in full (Send check or money order); or, send only **$2** now and pay postman balance plus postage upon delivery. Catalog of Dremel Tools and Accessories FREE.

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EASY TO ASSEMBLE KITS

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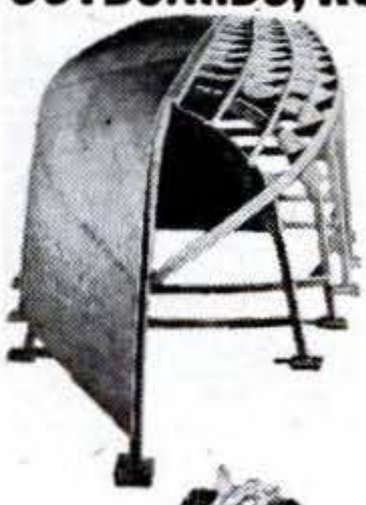

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Colorful Illustrations show all '49 Models, 8 to 23 Ft., and Construction Details.

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NEW *Electric* SANDER

Amazing MOTO-SANDER AND POLISHER

Say "Good-bye" To Hand Sanding & Polishing!

Let speedy **"Moto-Sander"** do the work while **you** just guide it. Ideal for light sanding jobs. Use **Moto-Sander** for finishing, refinishing, redecorating. Quickly and smoothly sands furniture, walls, woodwork, wall board, plaster joints; boats, workshop projects, etc. **Straight-line action** (non-rotary) will not burn or scratch surface. Use **Moto-Sander** also for fast, effortless **polishing** of furniture, refrigerator cabinets, automobiles, other waxed surfaces. There are dozens of time and money-saving uses in every shop and home for this inexpensive machine. **Moto-Sander** is the lightest, most practical electric sander on the market. Delivers 7,200 strokes a minute . . . works into those hard-to-get-at places . . . weighs only 2½ lbs. Furnished complete with 6 sheets assorted grade Garnet Paper for sanding, plus **felt pad** and **sheepskin** for wax polishing. Operates on 110-120 V., 60 cycle A.C. Thousands of satisfied users.

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- **Sand Furniture and Woodwork**
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- **Sand Walls before painting**
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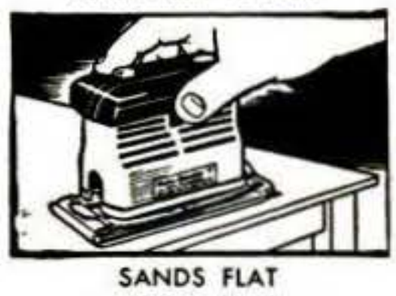


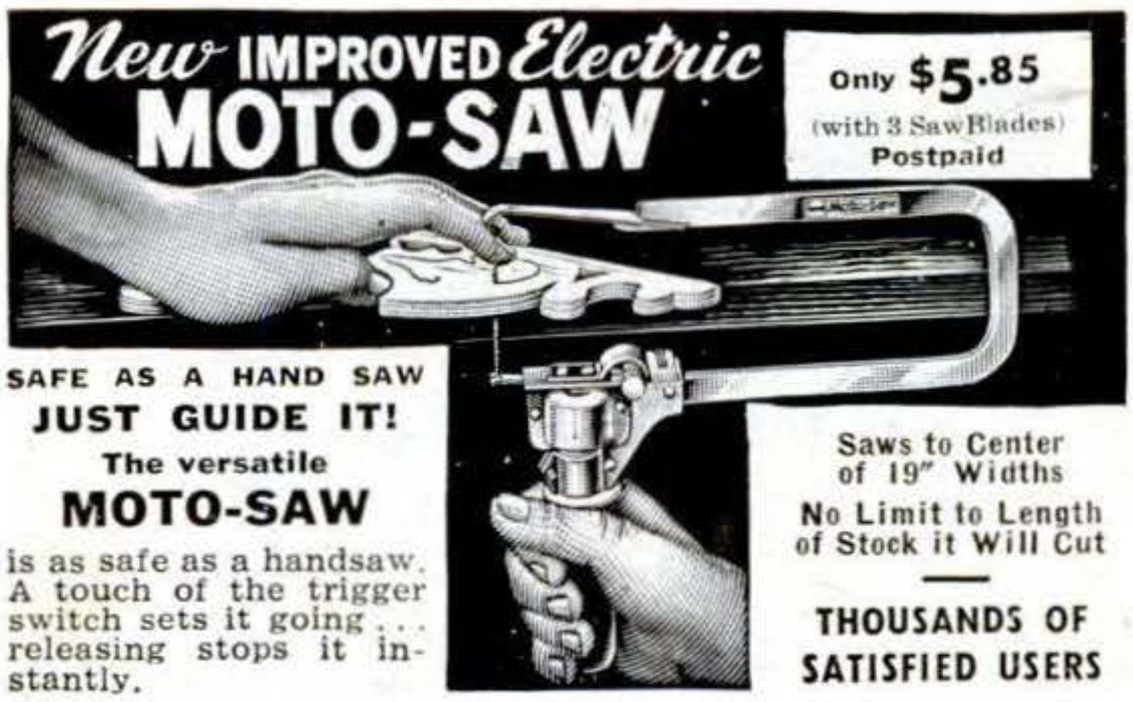
SANDS FLAT SURFACES EVENLY

GETS INTO TIGHT CORNERS

ROUNDS CORNERS LIKE MAGIC

New IMPROVED *Electric* MOTO-SAW

Only $5.85
(with 3 Saw Blades)
Postpaid



SAFE AS A HAND SAW
JUST GUIDE IT!
The versatile
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is as safe as a handsaw. A touch of the trigger switch sets it going . . . releasing stops it instantly.

Saws to Center of 19" Widths
No Limit to Length of Stock it Will Cut

THOUSANDS OF SATISFIED USERS

AVERAGE CUTTING SPEED ONE FOOT PER MINUTE

Moto-Saw works more like magic than any tool you ever saw! Takes no effort to run . . . no perceptible pressure to feed . . . only a trifle heavier than a hand scroll saw, and better balanced in your hand. Runs 7200 strokes a minute . . . leaves no rough edges . . . easily cuts intricate scroll designs in medium hard wood up to ¾" thick. Blade holder faces blade 4 ways . . . permits sawing sideways as well as forward and backward. Sturdily constructed . . . only two moving parts . . . never needs oiling . . . requires no bench room or floor space. Operated on alternating current. Thousands of satisfied users.

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Exclusive GIL-BILT Build-It-Yourself Features

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- Sturdy wood, aluminum, and steel construction
- Capacity and performance of commercial saws selling for $60 and up

GIL-BILT 10-INCH TILTING ARBOR SAW

- 27x28 in. table, 13½ in. capacity in front of blade
- 10 in. blade cuts 3¼ in. deep, tilts full 45 degrees
- Floor model 34" high table always stays level
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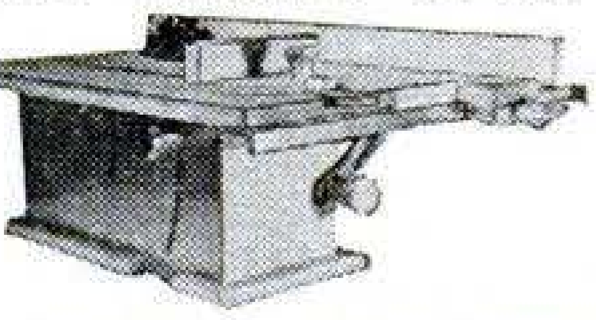
- Cast aluminum miter gauge and self-aligning rip fence guide

Gil-Bilt Metal Parts Kit includes Plans, Ball Bearing Arbor, Miter Gauge and Bar, Rip Fence Guide, Machined Lock Knobs, Jackscrew Mechanism and Handwheel, and All Other Metal Parts (less blade) **$20.95**
Same Kit with 10" comb. blade...... **25.90**
Same Kit with 8" comb. blade...... **24.90**

GIL-BILT 8-INCH TILTING TABLE SAW



- 21x27 in. table tilts full 45 degrees. 13 in. capacity in front of blade
- 8 in. blade cuts from 0 to 2½ in.
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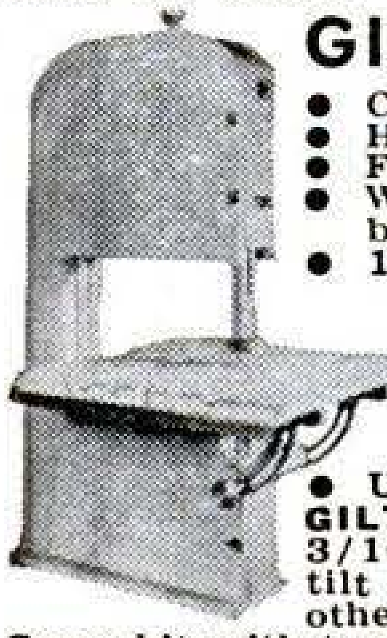
- Cast aluminum miter gauge and self-align. rip fence guide (same as above)

GIL-BILT Metal Parts Kit includes Plans, Ball Bearing Arbor, Miter Gauge and Bar, Rip Fence Guide, Machined Lock Knobs, Tilt Support Segments, and All Other Metal Parts (less blade)........**$15.95**
Same Kit with 8" Combination Blade.................... **19.90**

GIL-BILT 12-INCH BAND SAW



- Cuts to center of 24 in. circle
- Handles stock up to 6 in. thick
- Fully enclosed mechanism for utmost safety
- Wheels turn on heavy ⅝ in. shafts, four Oilite bronze bearings
- 18x18 in. table tilts 45 degrees
- Upper wheel tension and tilt mechanism of cast aluminum; completely assembled
- Two blade guides, each has ball thrust bearing, self-lub bronze jaws
- Rubber tired wheels. Choice of cast alum. or make-your-own wood wheels on metal hubs
- Uses standard 78 in. blades up to ⅜ in. wide

GILT-BILT Metal Parts Kit Includes Plans, rubber tires, 3/16" blade, hubs for wood wheels, bearings, shafts, tilt mechanism, guides, tilt support segments, and all other metal parts........................**$16.95**
Same kit with two ready-to-install 12" cast aluminum wheels **$20.95**

NO DEALERS—ONE LOW PRICE! Prices include postage up to 600 miles. Send cash, check or money order for complete kit, or send $1.00 for each set of Step-by-Step Plans and Order kit later less cost of Plans. Plans sent postpaid anywhere in the world.

COMPLETE PLANS *only* $1.00 EACH

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STOP CHANGING MOTOR OIL-- KEEP IT CLEAN INSTEAD!

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The Famous *HEATED* Oil RE-REFINING Filter!

Continuously cleans and **RE-REFINES** motor oil as you drive (by utilizing motor heat)—keeps oil in high grade lubricating quality at all times—reduces motor wear to a minimum! Proves conclusively that **"Oil Does Not Wear Out Mechanically"** as stated by **U. S. Bureau of Standards, (Bulletin 86).**

NEW ADDED FEATURE! **Gas-Moisture Vapor Injector** Increases Mileage with Smoother Performance

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- **REMOVES SOLIDS (by filtration)**
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- **PREVENTS Excess Fuel Dilution**
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MAINTAINS Stable Viscosity **ELIMINATES** All Oil Changes

CAR • TRUCK • TRACTOR OWNERS!

You'll want to know more about Reclaimo's Oil, Motor and Money-Saving Features. **FREE 40-PAGE BOOK "OIL FACTS"** gives you the complete "Reclaimo" story plus details about our **New 90-Day No Risk-No Cost TRIAL OFFER!** WRITE for YOUR COPY TODAY!

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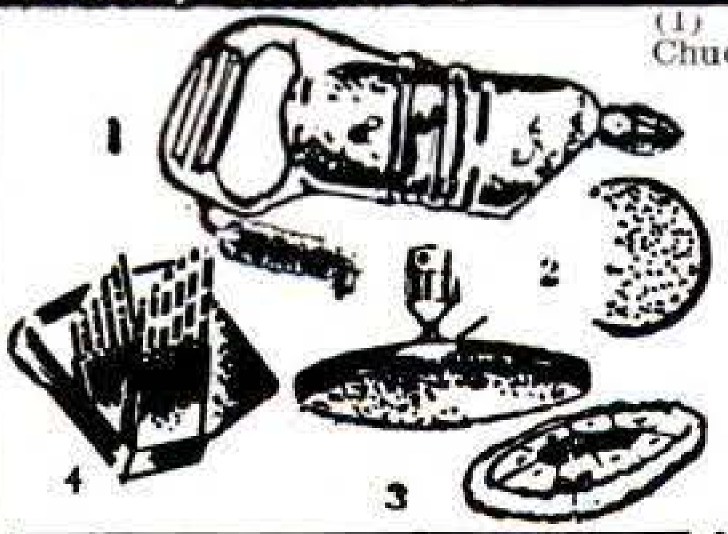

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(2) 5" Flexible Rubber sanding attachment with 12 sheets sandpaper **$3.50**
(3) 5" Lamb's wool bonnet (for polishing cars, furniture, silverware, etc.) **75c**
(4) 13-Pc. Hi-Speed Drill Set (complete with Hunt container. Sizes range from 1/16" to ¼") **$3.25**
If Purchased Separately....**$26.45**

SPECIAL on All Four Items
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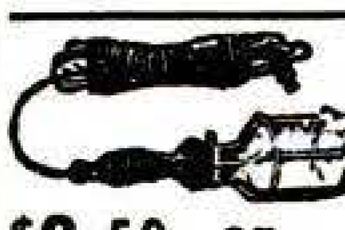
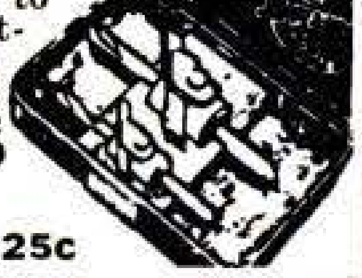


BRAND NEW HEAVY DUTY 50 Ft. Extension Cord. Complete with Switch & plug In.
$2.50 ea. P.P. 25c
Special Discount—On quantity orders.

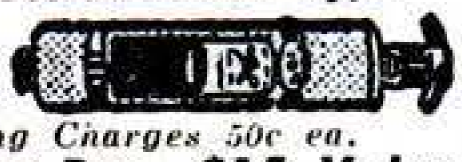
HOLE CUTTER SET



Cuts from ⅝" to 2½" holes in metal, plastic, wood, etc. Use in Drill press or Electric drill. **Reg. $9.00 value.**
$5.95 ea. P.P. 25c

NAVY SURPLUS
1½-Qt. Fire Extinguisher
Carbon Tetrachloride Type

$6.95



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Complete with bracket
CARBON TETRACHLORIDE FLUID for EXTINGUISHER, qt. $1.00
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A.C. 115 volts, exhaust for dark room, small toilet, — Complete with Adjustable Draft Control.
$9.50 each P.P. 50c

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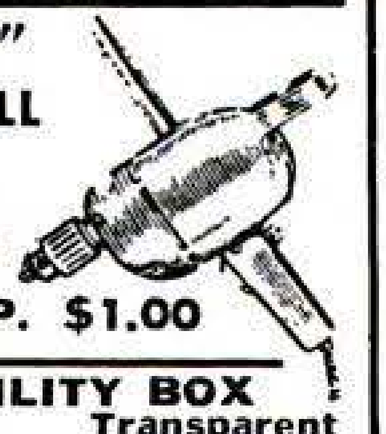

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Used & moved in a second. Makes working on a ladder a pleasure. A level platform at any ladder pitch. Light & Strong. For Painters, Carpenters, Roofers, etc. **Reg. $3.50 Value**
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ALL PURPOSE Rotary Lawn Mower

Does a smooth clean job on the finest lawn and will also cut tall grass and weeds along fences, alleys, etc. Light weight, sturdy aluminum chassis. Timken bearing spindle. Ball bearing wheels with semi-pneumatic tires. Available with or without engine. Write for free Circular. **CAN YOU SELL?** Ask about our special offer to dealers and salesmen.

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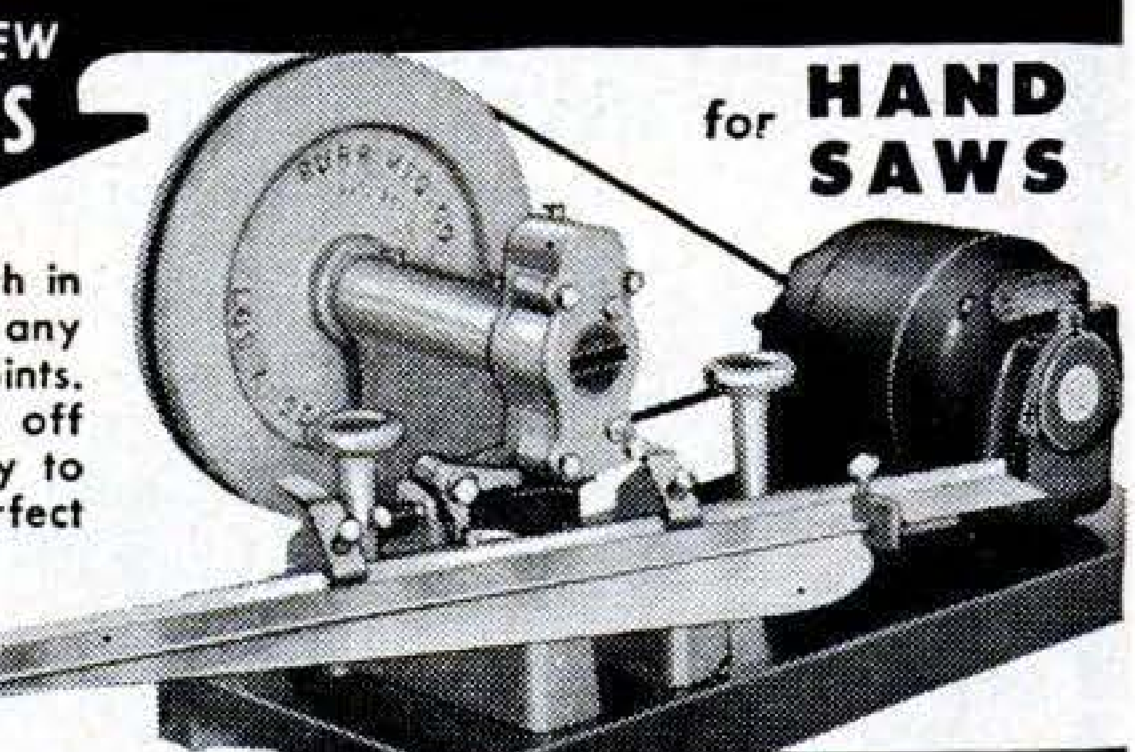
MAKES NEW **PROFITS** for **HAND SAWS**



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PS 449

This Amazing Hand Tool Has Everybody Talking!

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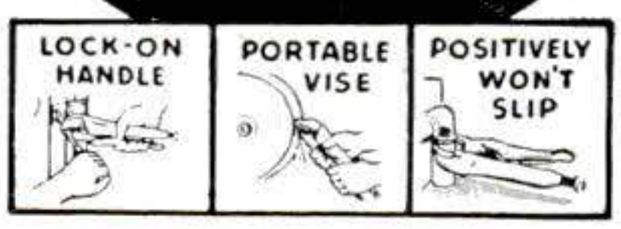

And no wonder! You can search the world over and nowhere will you find a tool with the genuine usefulness of the New VISE-GRIP wrench. Does jobs impossible with any other tool.

- **LOCKS with terrific grip**
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- **Exclusive Involute Jaw Curve combined with Knurled Jaw Tips, Thin Nose and Wire Cutter makes this tool perform with real magic.**

Fine alloy steel. Nickel plated finish.

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No. 7W—7-in.	$2.25	No. 7C—7-in.	$1.85
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Ask for "tell-all" booklet entitled "Opportunities in Floor Surfacing". Use coupon and enclose 25 cents in coin or stamps to cover handling.

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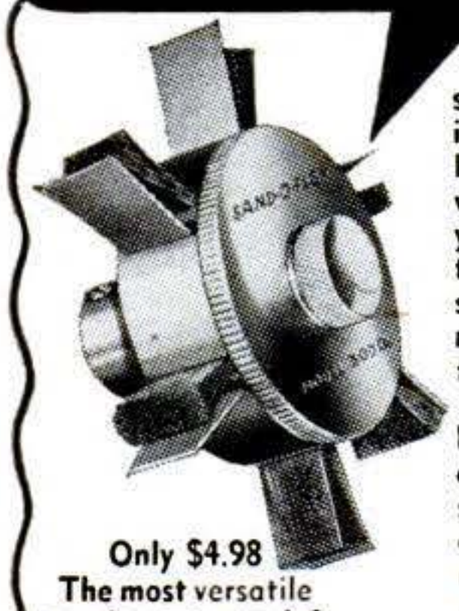
use the new SAND-O-FLEX on curved and irregular surfaces



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Money-Back Guarantee

Use Sand-O-Flex on contoured and flat surfaces alike. This low-cost sander reaches into recesses, around intricate curves, and handles all those tedious finishing jobs that were formerly done only by hand. Fasten it to your motor shaft or any of your present stationary or portable power tools. The ideal sander for a hundred home uses. Finishes any material—woods, metals, compositions. Satin finishes stainless steel!

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☐ For 1/2" Shaft ☐ For 5/8" Shaft

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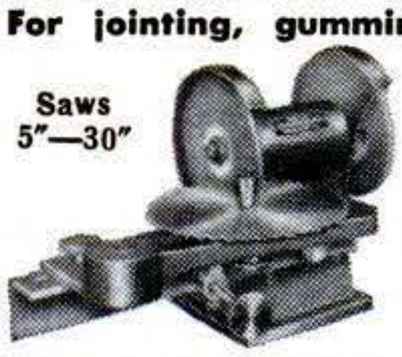
For jointing, gumming, tooth forming and resharpenin



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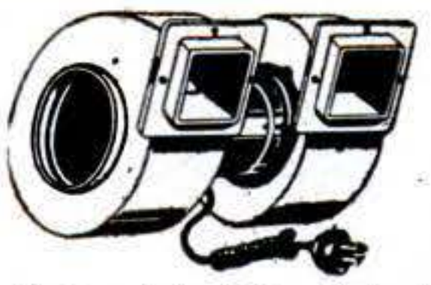

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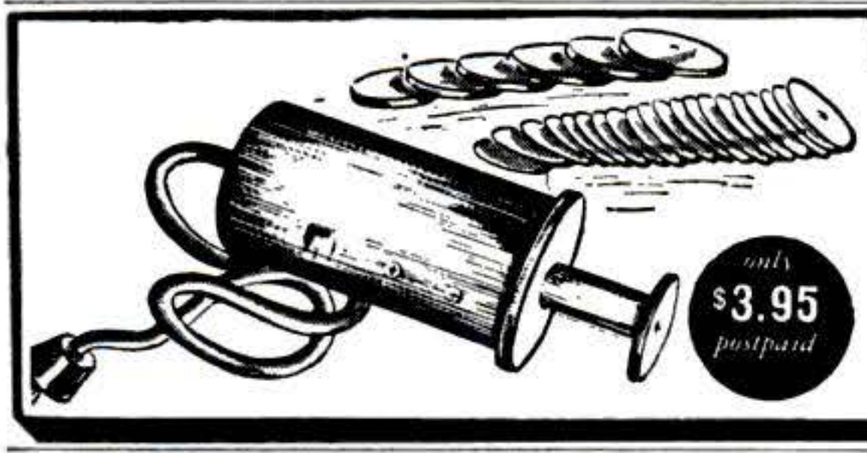

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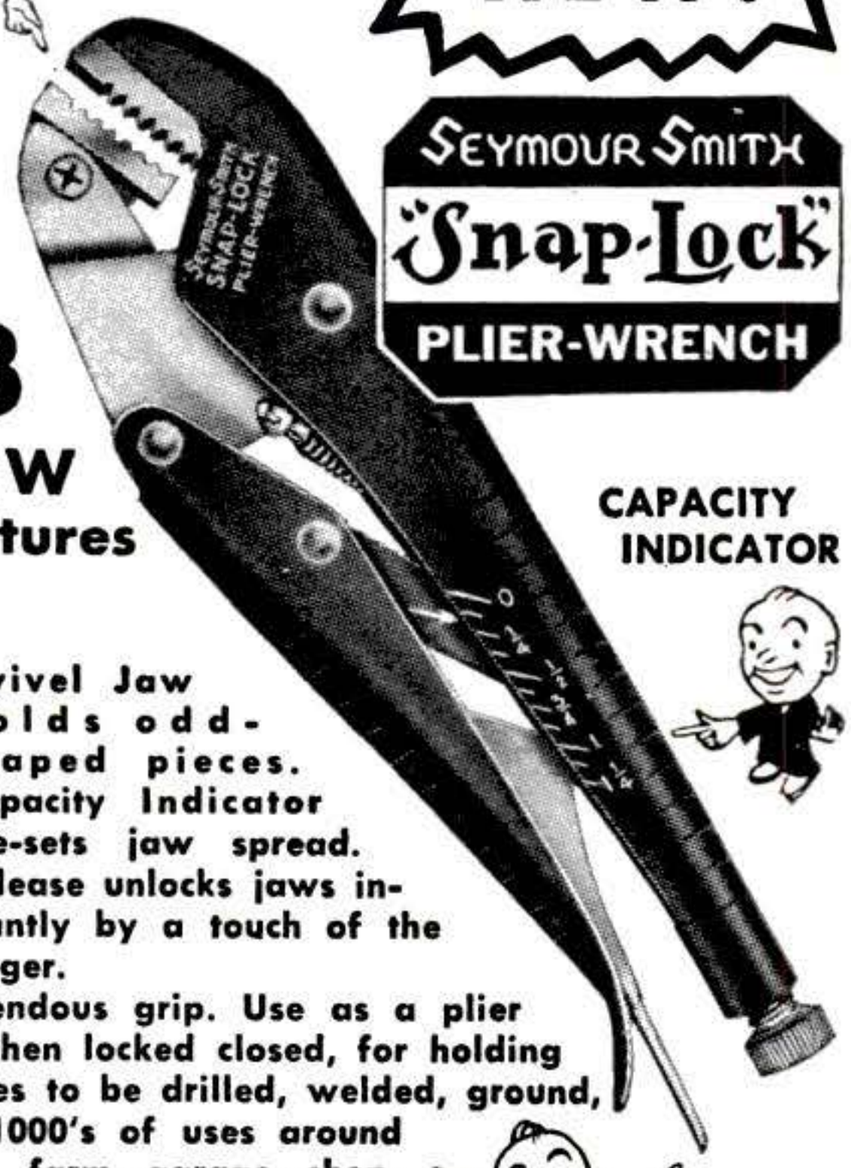

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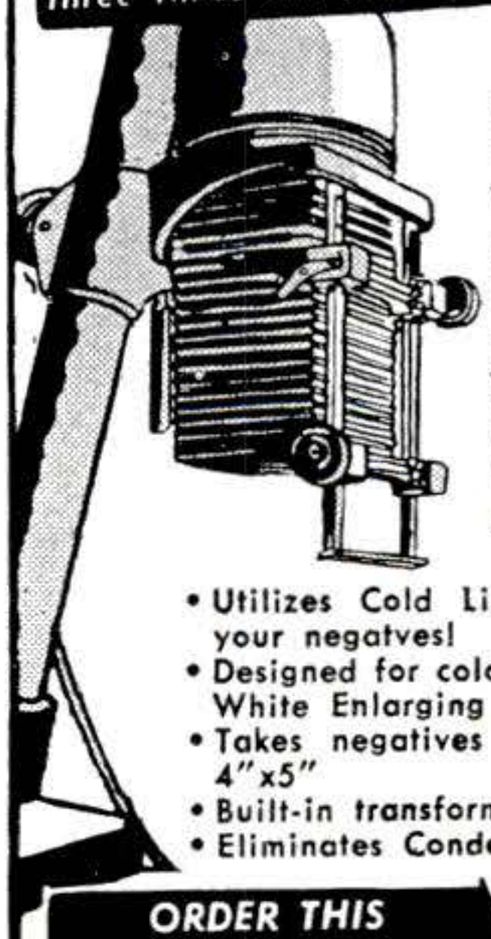

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Just send your name and address. Specify white or black or two giant spools for only $3.29. On arrival, deposit only $1.69 per spool ($3.29 for two spools) plus C.O.D. postage on our guarantee if you are not delighted, you can return in 10 days and your money back. Cash with order, we pay postage. **Limited Supply. Write Today.**

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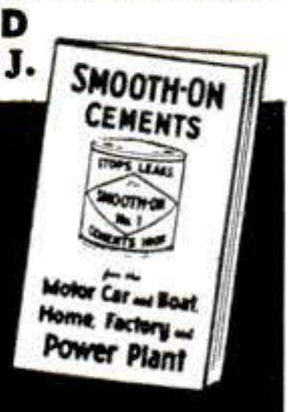

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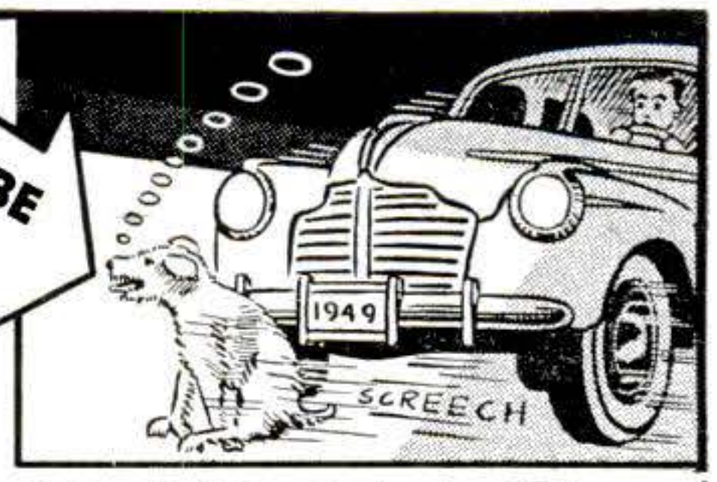

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plus pressure tank, pop valve, gauge for tank, air regulator and gauge, filter, 20 ft. air hose, check valve and air chuck.

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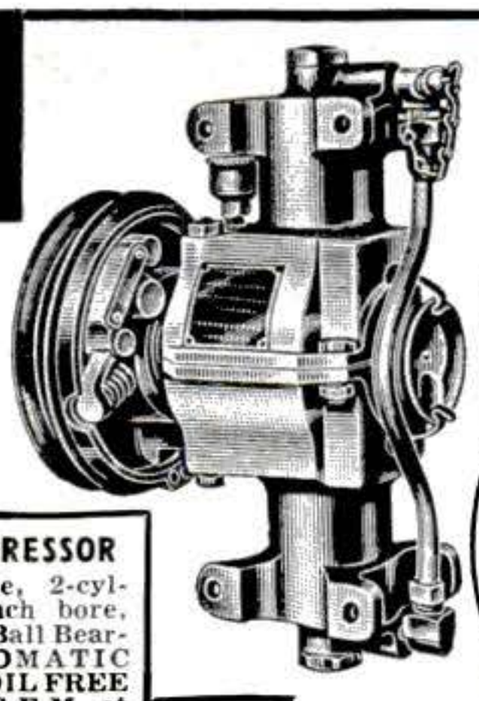

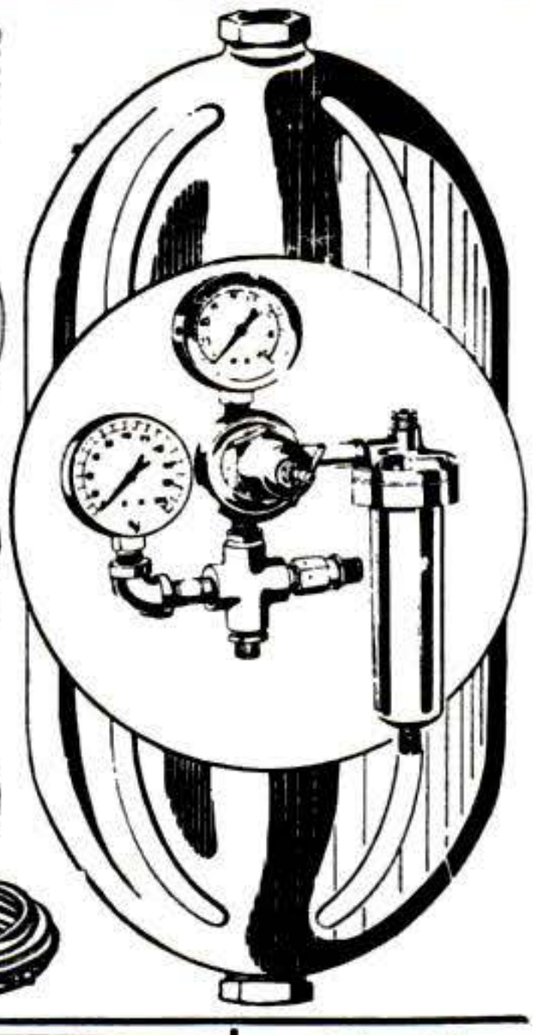

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Piston Type, 2-cylinder, 2 inch bore, 1½" Stroke Ball Bearing, AUTOMATIC CLUTCH. OIL FREE AIR. 3.27 C.F.M. at 600 R.P.M. 6.54 at 1200. Suggested operating pressure 75 P.S.I. DIMENSIONS: 9" wide, 11⅞" high, 6⅝" deep. Wt. 23 lbs.

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Compressor separately, **$22.50**
Equipment Less Compressor $19.50

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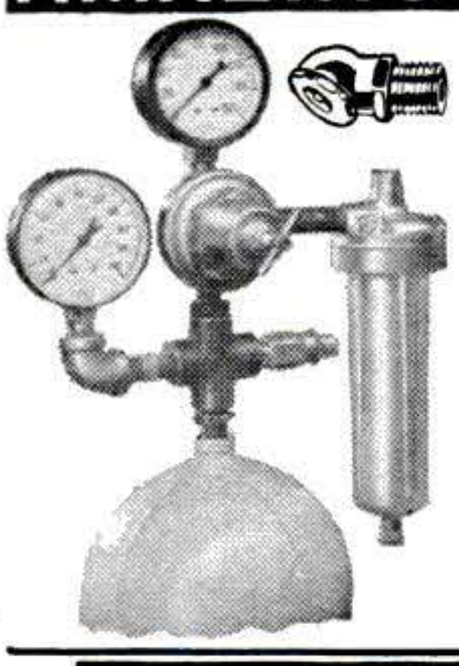

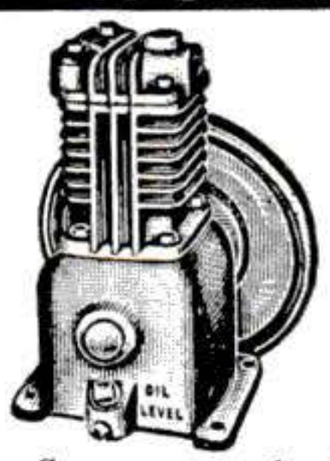

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Tank and accessories as shown above—**$14.50.** Wt. 7 lbs.
Adjustable ¼" Pop Valve—**$1.50**
2½" Air Gauge—**$1.75**

Air Compressor: Piston type, size 2 x 1¾", both valves in head, bronze bearings, splash lubrication, "V" Belt drive. Intake muffler and cleaner. Capacity 2.8 c.f.m. at 100 lbs. continuous pressure or 150 lbs. intermittent, with ½ HP motor. Can be used with ¼ HP or ⅓ HP at lower speed. Wt. 14 lbs. Operating instructions furnished.

Air Tank and Accessories: Stainless steel 6" x 24" with gauge and safety valve, air regulator gauge and filter, drain cock, hose connection. Suitable for 100 lb. pressure.

SENSATIONAL OFFER!

Complete outfit consists of compressor, pressure spray gun with 2 nozzles, pop valve, 20 ft. hose, air tank and accessories as described, air chuck. Complete for only $37.50

Automatic Pressure Switch With Unloader

Double pole, with 2 way release valve. Set at 125 to 150 lbs. pressure. For use on compressor units ¼ to 3 H.P. Pressure range 20 to 200 lbs. Weight 4 lbs.
ONLY $10.25

PORTABLE SPRAY OUTFIT

1/3 H.P. ELECTRIC MOTOR DRIVEN

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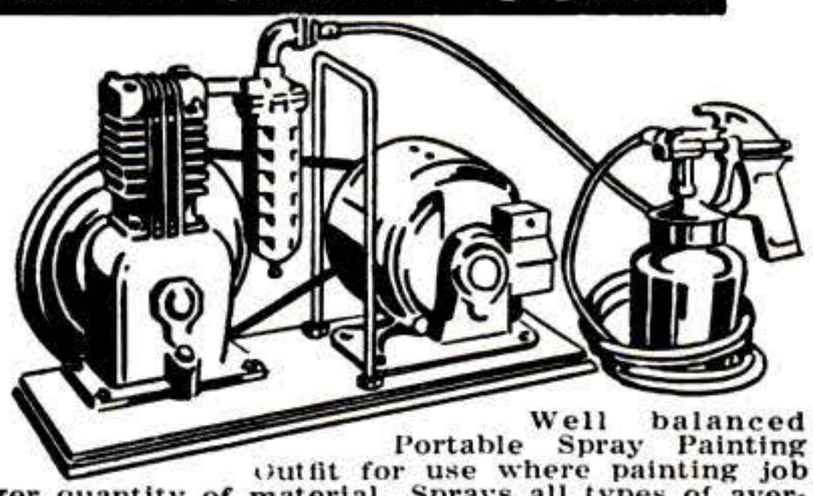
Complete With Base



Well balanced Portable Spray Painting Outfit for use where painting job requires a larger quantity of material. Sprays all types of average viscosity paints, enamels, lacquers, varnishes, etc. Piston type, single cylinder air compressor has 2 in. bore by 1¾ in. stroke. Displacement 2.86 C.F.M.; maximum working pressure 40 lbs. Mounted on sturdy wood base with rubber feet attached. Pulsation chamber is equipped with safety valve, drain cock. ⅓ H.P. G-E motor 110-volt AC, with cord and plug; 20 ft. air hose and fittings. Spray Gun is pressure feed type, internal atomizing, with one quart metal cup. Fan and round spray nozzle furnished. Shipping Wt. 50 lbs.

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SAVE $50.00

⅓ H.P. heavy duty capacitor motor AC 110/220 volt 60 cycle, 2 x 1¾ inch piston type compressor, splash feed lubrication, 12 x 24 inch tank, automatic pressure switch, pressure range 100 to 125 lbs., check valve, safety valve, air regulator with gauge and filter, 20 ft. air hose with air chuck for inflating tires. V. Belt drive. Shipping wt. 90 lbs.

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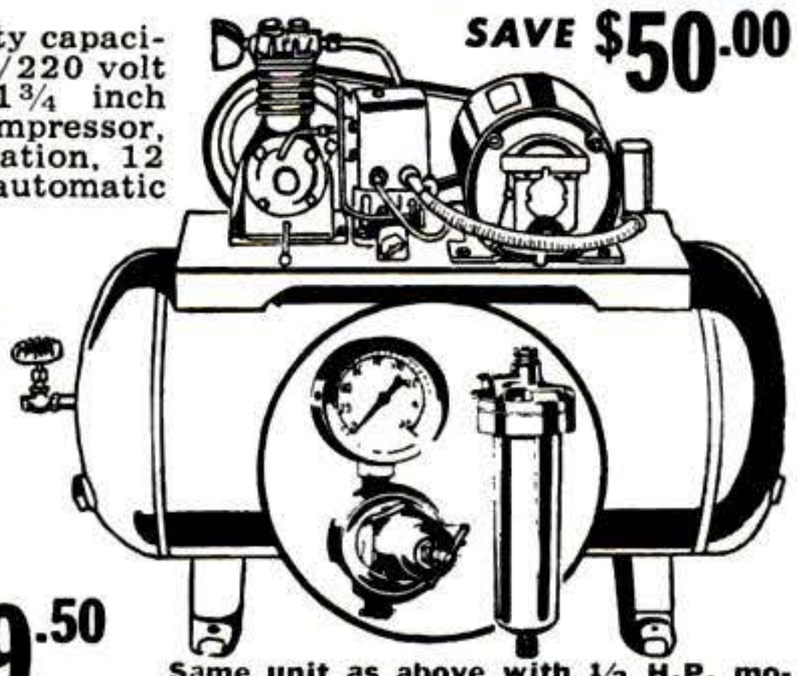

Same unit as above with ½ H.P. motor. furnished with 13" x 24" tank. Shipping wt. 125 lbs. Price..... $98.50

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CP4X Pistol grip handle with air control. Takes up to 3/16" rivet. Weight 6 lbs. List price $73.00.

Special Price $12.95 — **Same, as above, brand new $19.50** — **Size CP3—Takes 5/32" Rivet $8.95**

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With ¼" Jacob Chuck. Wt. 2 lbs. List price $55.00. Only..... **$15.00**

Ingersoll Rand AIR DRILL

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Push button, takes 5/32" rivet. Wt. 3 lbs. List price $65.00. Only..... **$8.95**

A.V.C. 10 Ingersoll Rand CHIPPING HAMMER

Takes ⅛" rivet. Wt. 3 lbs. List price $80.00. Only..... **$8.95**

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150 lbs. pressure. Has a close range of closing after pop-off pressure is reached. ¼" pipe thread.

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¼"	2.75
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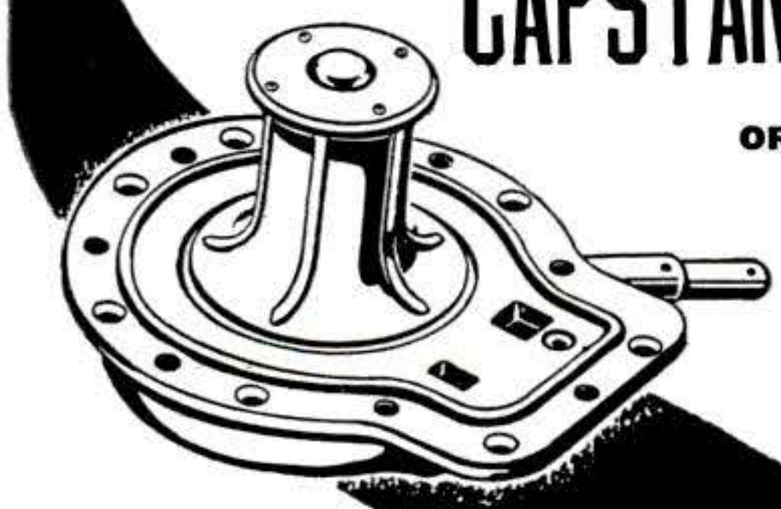

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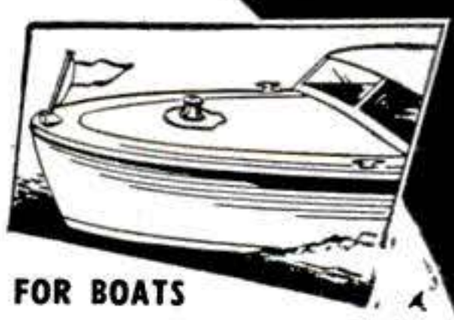

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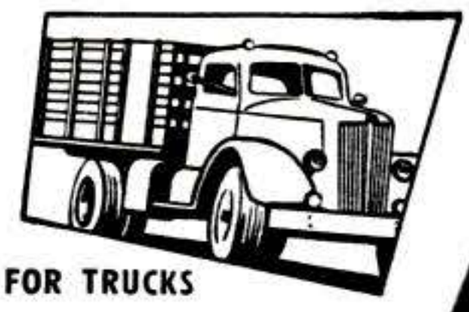

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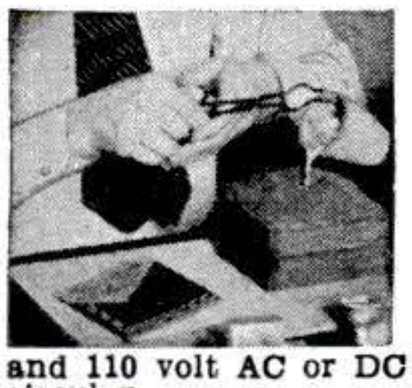

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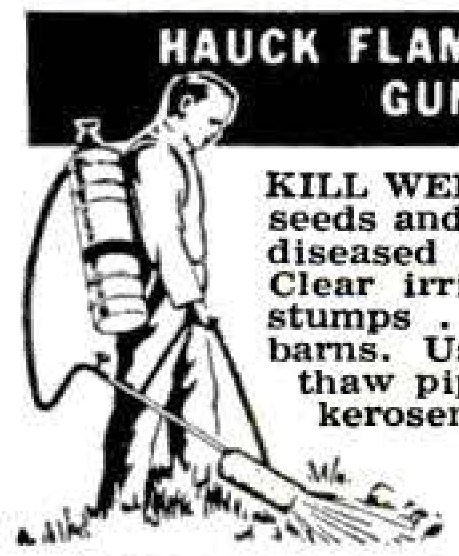

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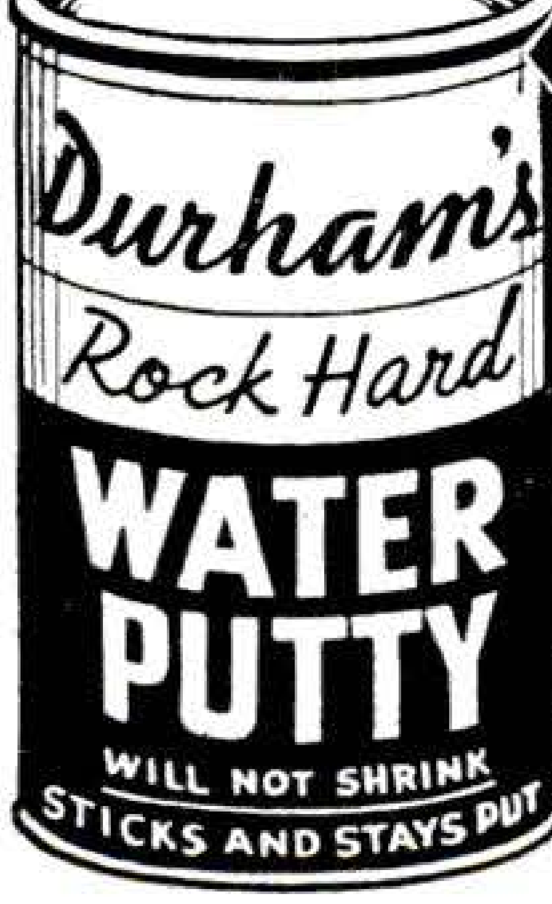

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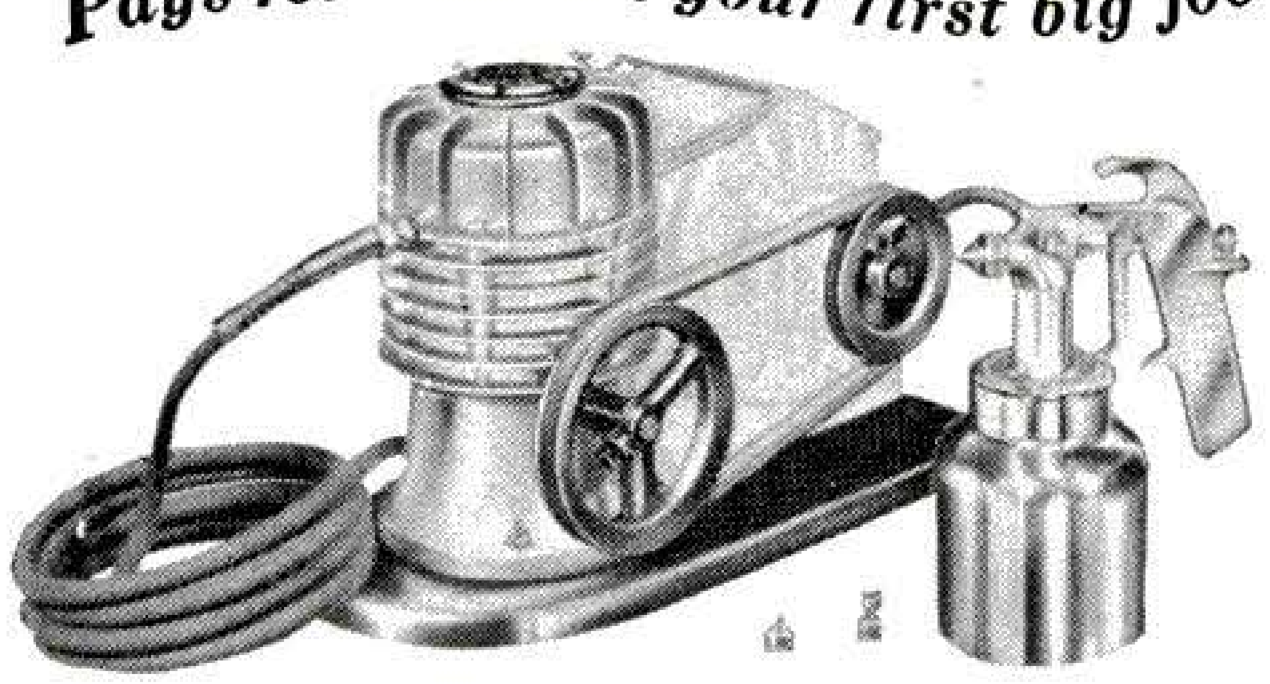

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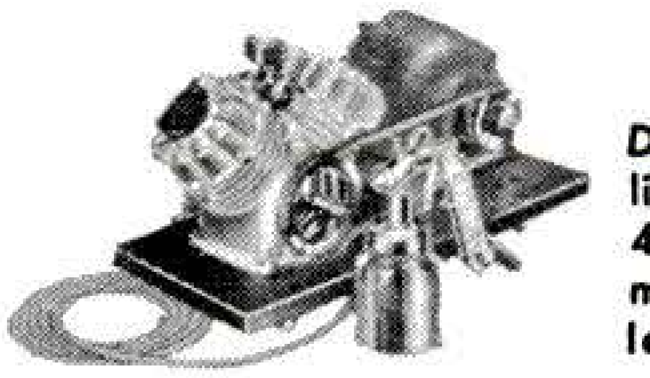

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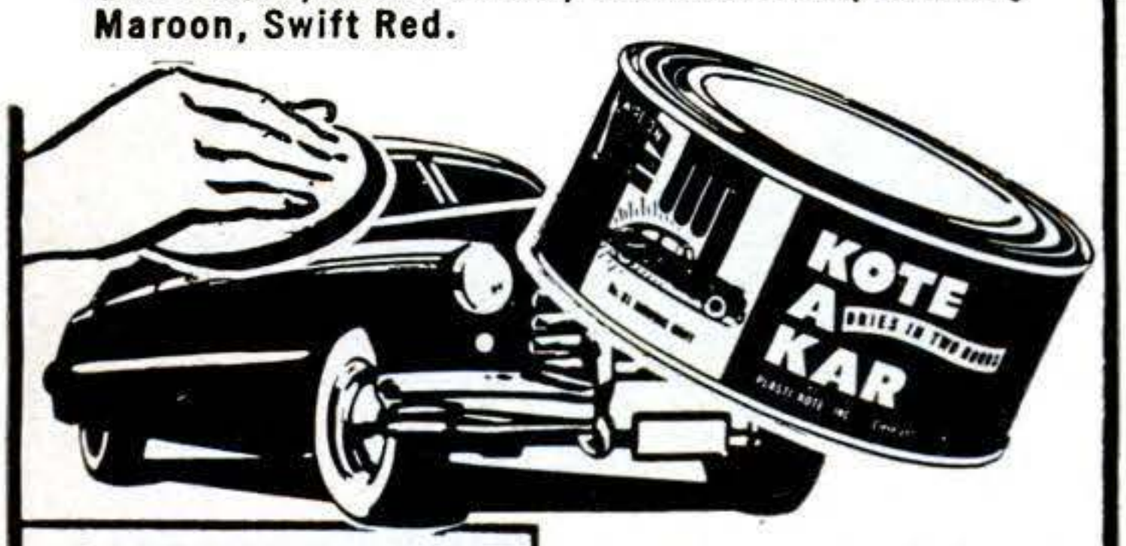

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Table-Top Barbecue. The Brazieret® turns out charcoal-flavored steaks right at your plate. A handful of standard charcoal briquets furnishes fuel for several hours. Made by S. A. Asquith Co., Los Angeles, it retails for about $17.

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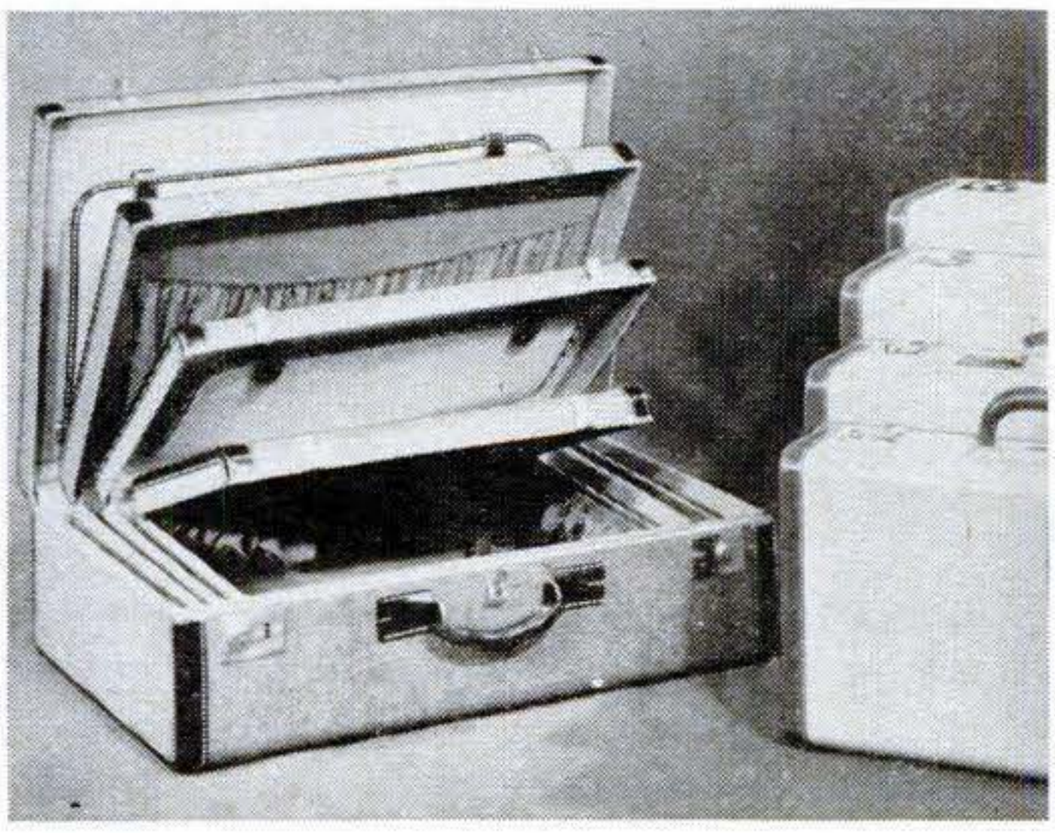
Modern Living

Motor Powers Can Opener. Driven by an AC-DC motor, this machine opens any container from a sardine tin to a five-gallon can. One motion locks the can in position and starts the motor. Another move of the knob stops the motor and releases the can. A compression spring in the center of the base compensates for rims of badly dented cans. Maker is Strong Appliance Industries, Inc., Danbury, Conn.



Three Bags Stored in One. The largest piece, 29″ long, holds three others 21″, 24″, and 26″ in length to save storage space. Made of waterproof canvas bound in cowhide, the set is priced at $100 by the maker, Brecher Brothers, New York City.

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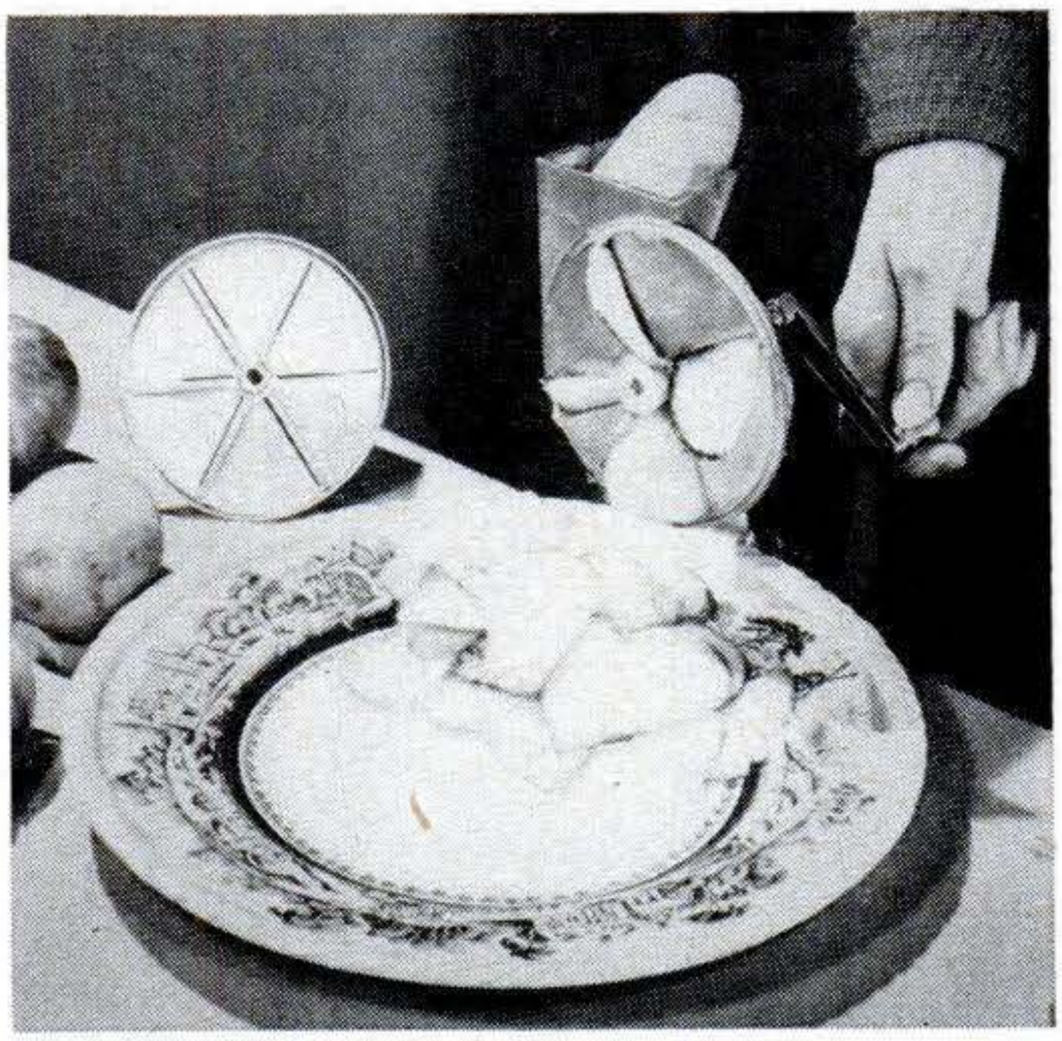
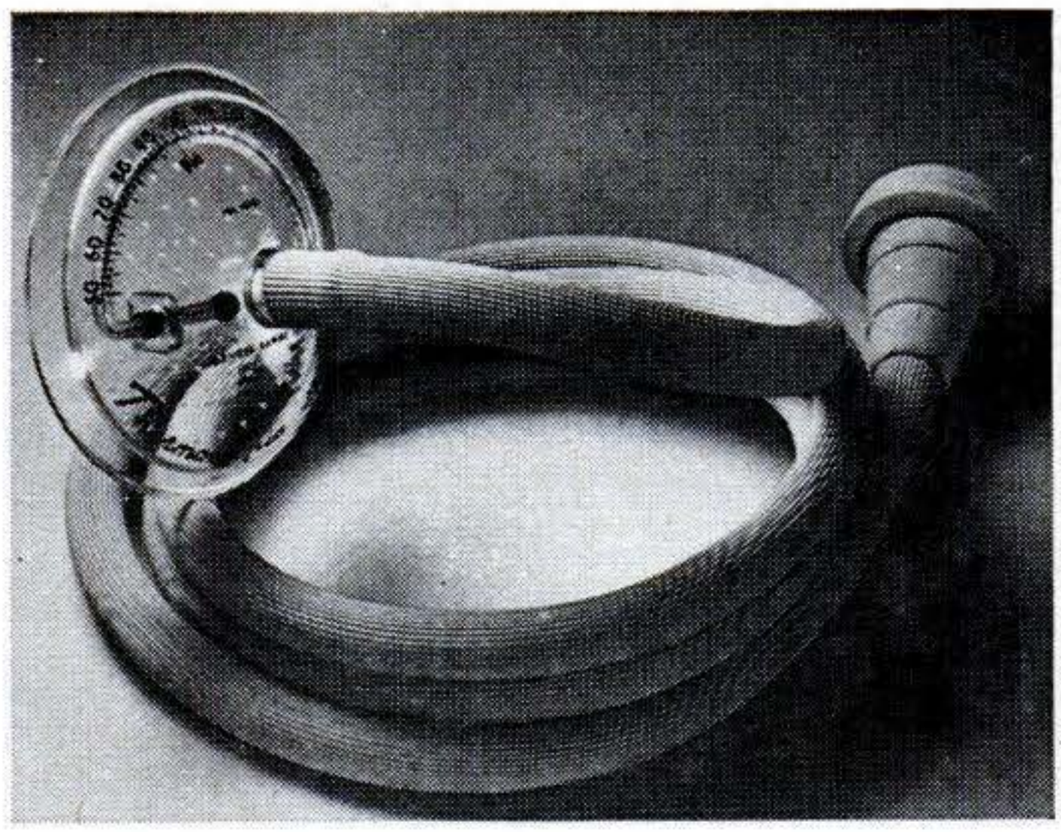


Food Shaver. Built of aluminum and finished in nickel, this shaver slices all kinds of vegetables and also chops nuts. A fine cutter blade is available to crumble dried bread and crackers and to grind up lump chocolate. Manufactured by Work Savers Industries, of Farmington, Mich., the shaver sells for about $3.50.



Thermometer Built in Spray. Reading from 60 to 160 deg. F., the curved thermometer in the head of the Thermoscopic® spray instantly gives the water temperature, according to the maker, Breau Plastic Industries, Philadelphia, Pa. The head is non-shattering, clear plastic. It comes with 5′ of white rubber hose and spigot adapter. The price is about $4. It's recommended for bathing, shampooing hair, and for laundering fine fabrics.

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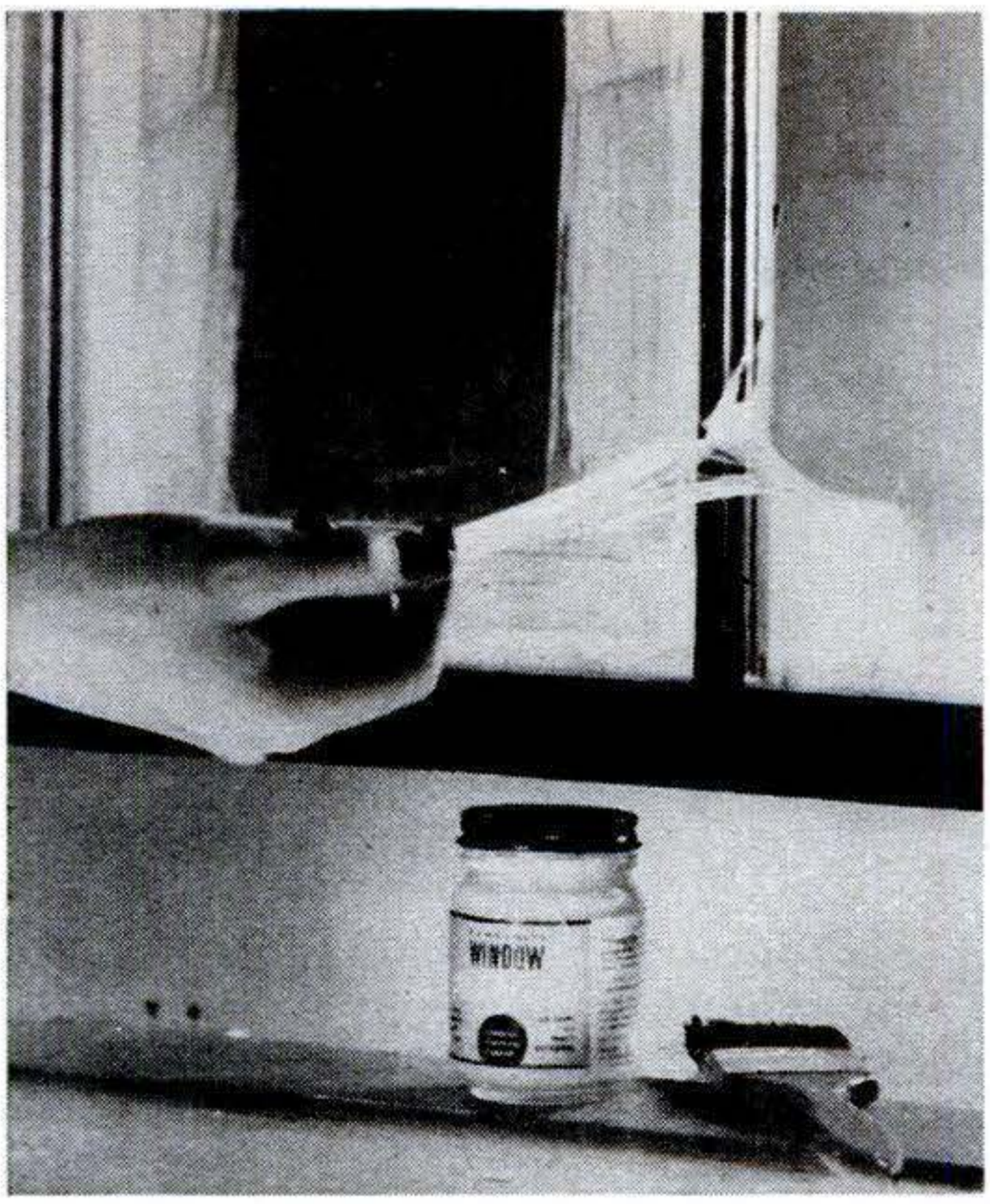
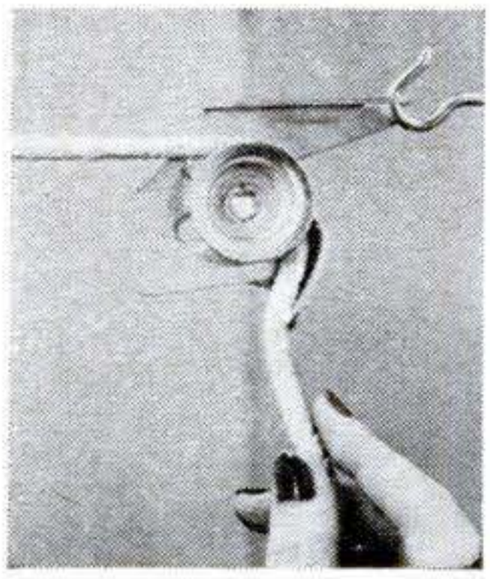
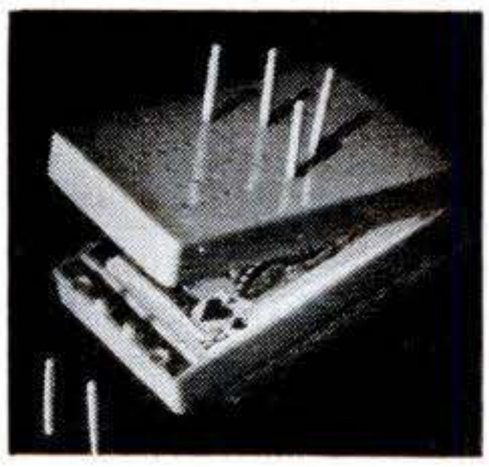


Masking Tape Is Liquid. You just brush this liquid—based on Vinylite® resins—on the surface to be masked. It dries in about 10 seconds and you're ready to paint. When the paint is dry, the plastic shield can be peeled off like tape. It's priced from 49 cents up, depending on the jar size. Ramsell Products, Maywood, Ill., is the maker.

Tightens Clotheslines. Quik-Tite ® tightens and locks a clothesline in one movement. Loop the line over the roller and pull down to take up the slack. To remove the line, pull down and release the grip. Easy to install, the tightener is made of cadmium-plated steel to resist rust. It's priced at 29 cents by Hall Industries, Inc., Chicago.



Folding Cribbage Board. This plastic board folds up, providing storage space for a deck of cards and the pegs. It's molded of lightweight polystyrene plastic and sold by the Nelson Products Company, of Arlington, N. J.



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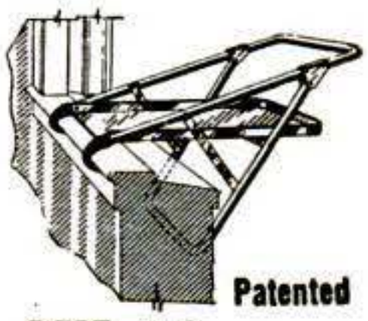

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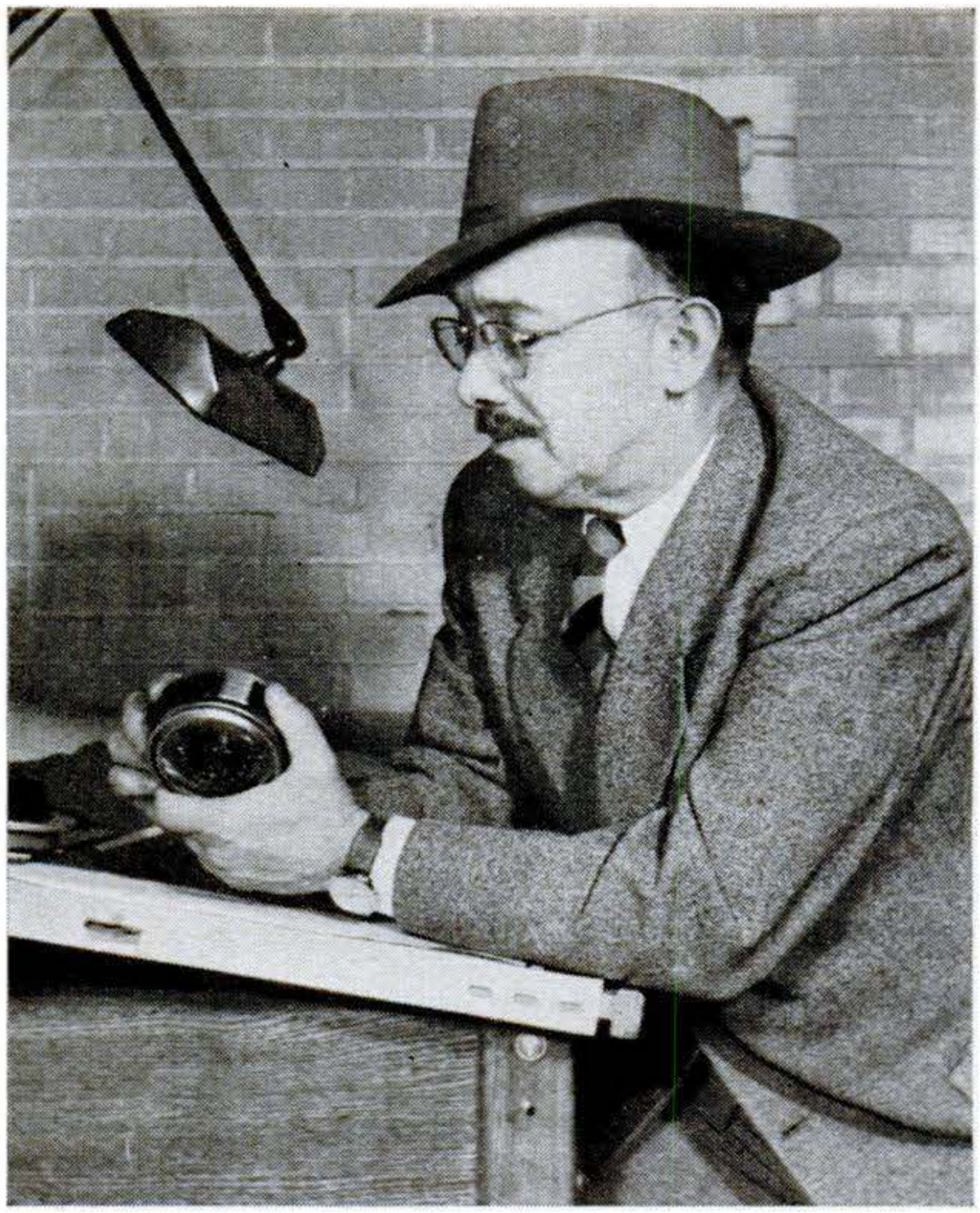
TO: Reader
FROM: Editor

Meet a Volunteer Editor



SOME of our ablest editors carry no press cards, sign no stories, and are not listed on the masthead. They are the volunteers, the big-shot executives and hot-shot mechanics who help make POPULAR SCIENCE understandable and authoritative.

Take Bill Barnes, for instance. We had been having some trouble with the overdrive story (see page 180). A well-known technical writer had filed his report. Our staff men had questioned car dealers and their service foremen. The story envelope bulged with manuals, sketches, and photographs. But we weren't getting the answers we wanted.

Then Stewart Rouse (you know his cutaways) flew to the Warner Gear plant in Indiana and reported that a man there named Barnes seemed to know all the answers. After some telephone palaver, we shipped Mr. Barnes a rough script.

The next thing we knew our receptionist was saying, "Mr. Barnes to see you," and there he was. We got our answers, and then some. We got the whole history of overdrive. We were led by the hand through its tricky mechanical principles. Mr. Barnes not only knew his subject, he loved it. And he talked with the enthusiasm of a proud father. In fact, to hear him talk, you'd think he'd *invented* the thing!

Well, he did. Bill Barnes holds the basic patents under which some three million of these semiautomatic transmissions have been built. He's the head man of Barnes Motor Developments Co., consulting engineer for Warner Gear, and is known in the industry as the father of overdrive.

This is the man who took time out to come to New York because he wanted PS to get the right answers, and all the answers. He is one of the many authorities on subjects ranging from atom smashing to tire changing who are glad to tell us what they know so that we can tell you.

Bill Barnes is a good example of the hundreds of busy men who spend hours and hours with PS writers, artists, photographers, and editors. Some of them are big brass in the armed services; some are big wheels in science, industry, or government. Some are specialists in less spectacular trades or jobs.

But all of these invisible editors have a common interest: they want to get you the straight dope.

Frank Rowsom

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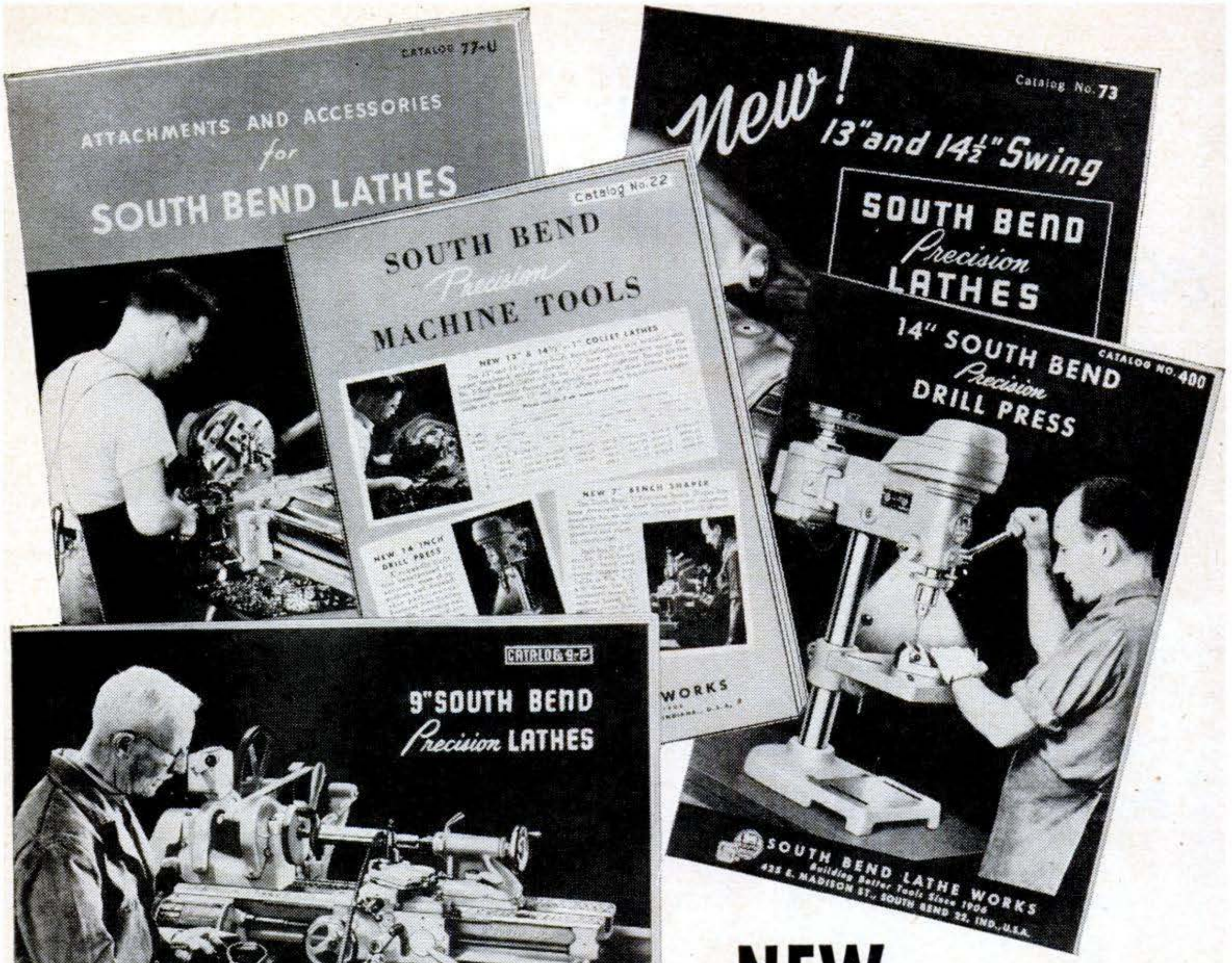

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CATALOG 73 describes the new 13" and 14½" Quick Change Gear and Toolroom Lathes with 1" maximum collet capacity; their Attachments, Accessories, Tools.

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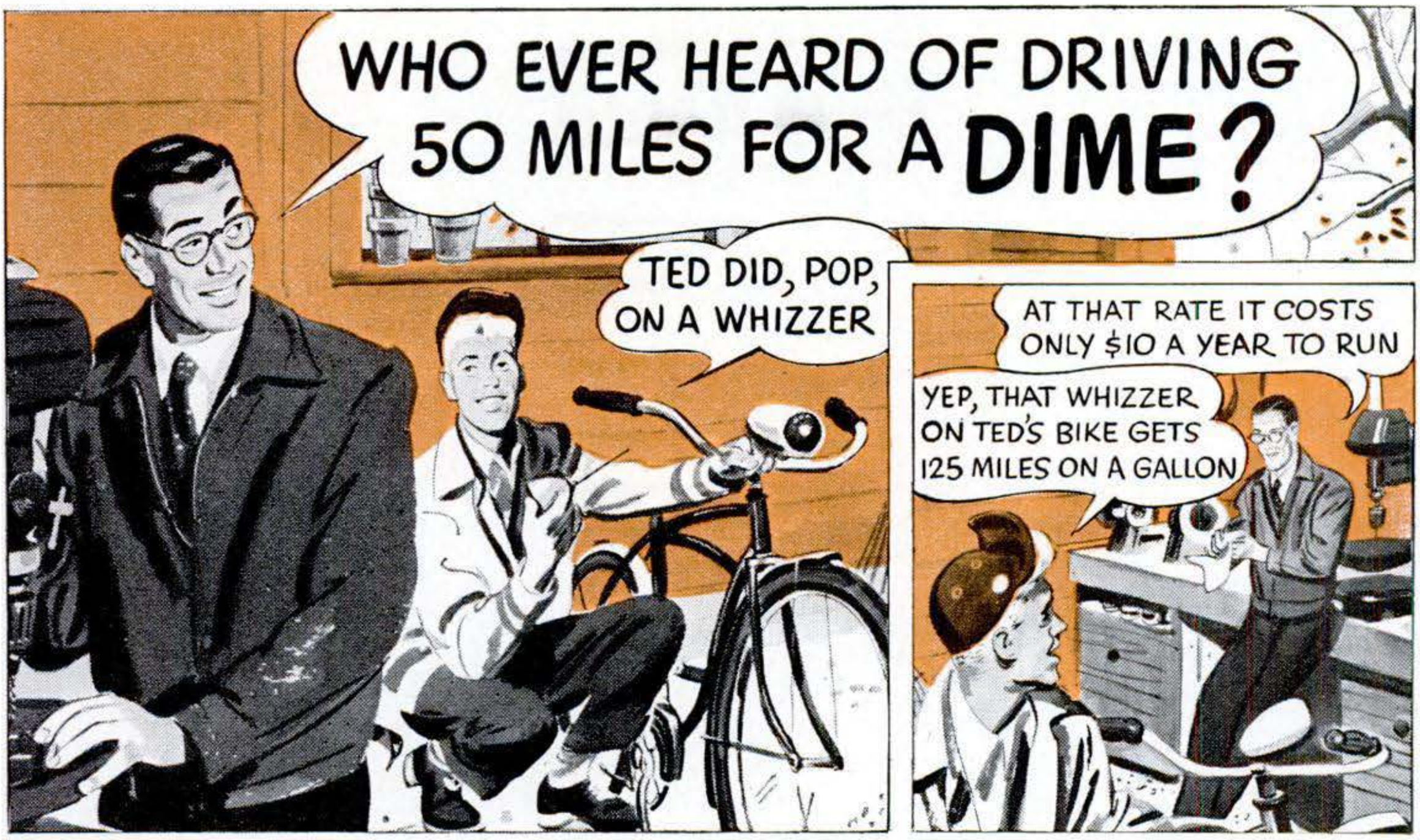

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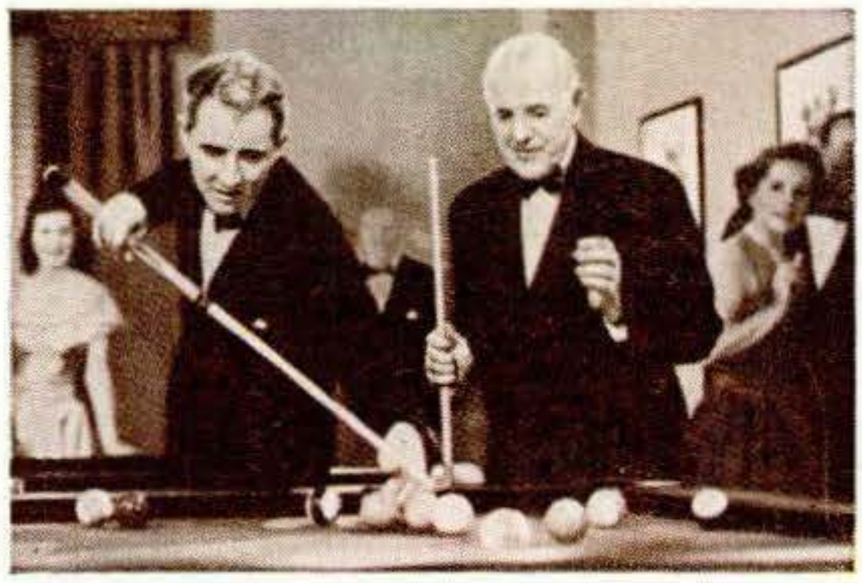
WILLIE MOSCONI

World's Pocket Billiard Champion, 1947 and 1948, holds pocket billiards high-run record of 309 balls in succession and match single game record of 127. Mosconi also rates as a 3-cushion expert.



WILLIE HOPPE

A champion since '06, the veteran Willie Hoppe has held every title in carom billiards. After 44 years of competition, he's still world's 3-cushion champion.

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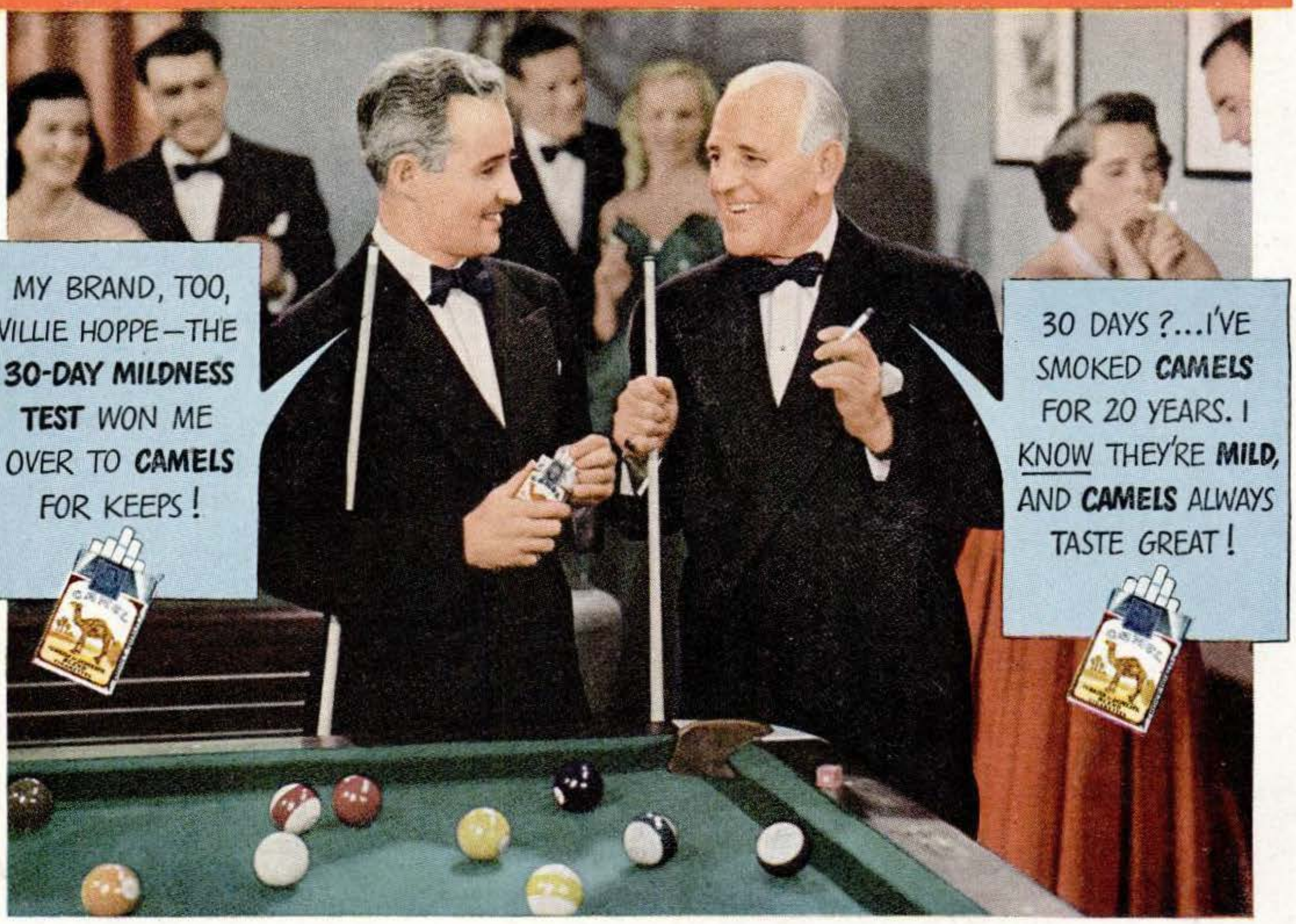

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